MAY • 1948

VOLUME XIX NUMBER 8

the Petroleum Engineer

...ds for Operating Men

MEETINGS

May 15-22—International Petroleum Exposition, Tulsa, Okla.

May 27-28—API, Rocky Mountain Production Division, Townsend Hotel, Casper, Wyoming.

May 31-June 6—LPG Assn, annual convention and trade show, Sacramento, Calif.

June 2-4—Gas Technology Annual Short Course, Texas A & I College, Kingsville.

June 6-8—Petroleum Equipment Supplier's Assn, annual meeting, Broadmoor Hotel, Colorado Springs, Colo.

June 7—Nomads, Louis Sherry's, 50th Street and Park Avenue, New York City.

June 9—Nomads, Jonathan Club, Los Angeles, California.

June 14—Nomads, The Houston Club, Houston, Texas.

June 21-25—ASTM, 51st annual meeting, Book-Cadillac Hotel, Detroit, Mich.

June 30-July 2—API, Eastern Production Division, Greenbrier Hotel, White Sulphur Springs, West Virginia.

June 30-July 3—Canadian Gas Assn, annual meeting, Jasper Park Lodge, Jasper, Alberta.

Sept. 6—Nomads, Louis Sherry's, 50th Street and Park Avenue, New York City.

Sept. 13-17—Instrument Society of America, conference and exhibit, Convention Hall, Philadelphia, Pa.

Sept. 14-16—Pacific Coast Gas Assn, annual meeting, Hotel Casa del Rey, Santa Cruz, Calif.

Oct. 4—Nomads, Louis Sherry's 50th Street and Park Avenue, New York City.

Oct. 4-6—AIME, Petroleum Division, fall meeting, Adolphus Hotel, Dallas, Texas.

Oct. 4-9—AGA, technical section, annual meeting, Ambassador Hotel, Atlantic City, N. J.

Oct. 4-9—American Association of Petroleum Geologists, midyear meeting, Pittsburgh, Pa.

Oct. 11-13—National Lubricating Grease Institute, annual meeting, Edgewater Beach Hotel, Chicago, Ill.

Oct. 11-13—American Assn of Oilwell Drilling Contractors, annual meeting, Rice Hotel, Houston, Texas.

Oct. 14-15—AIME, Petroleum Division, Elks Club, Los Angeles, Calif.

Oct. 14-15—Texas Mid-Continent Oil & Gas Assn, annual meeting, Fort Worth.

Nov. 8-11—API, annual meeting, Stevens Hotel, Chicago, Ill.

Nov. 15-18—American Oil Chemists Society, fall meeting, Pennsylvania Hotel, New York.

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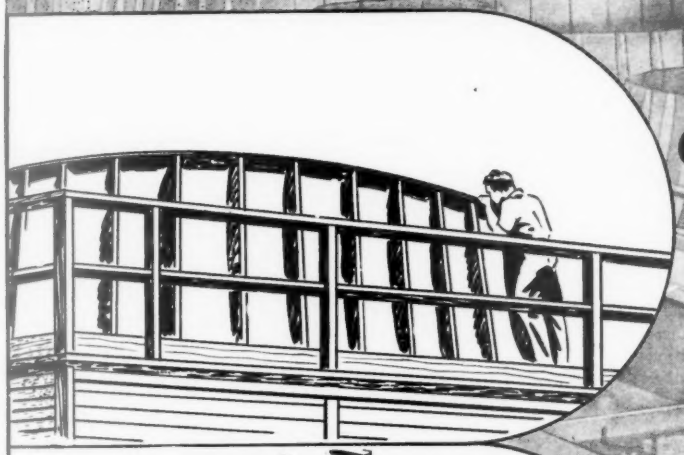

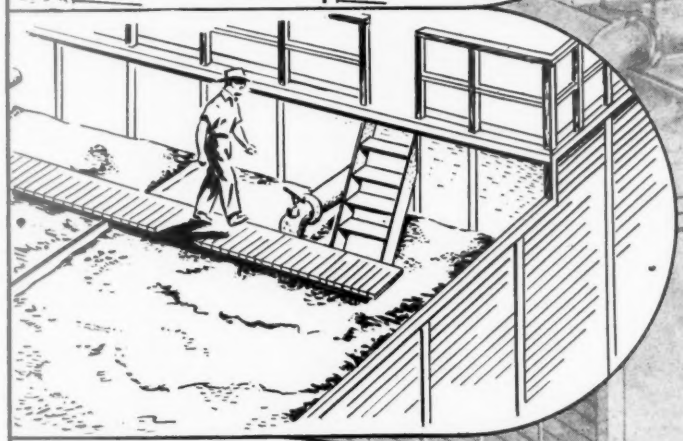

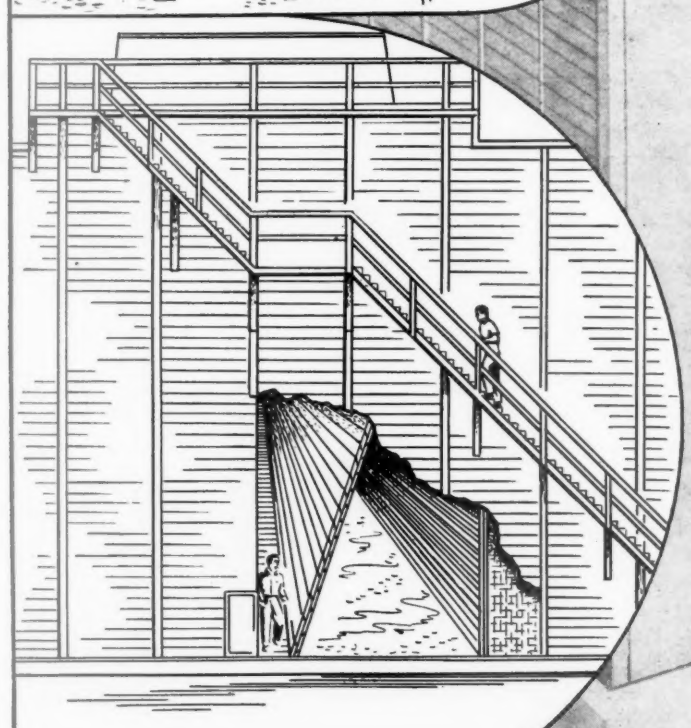

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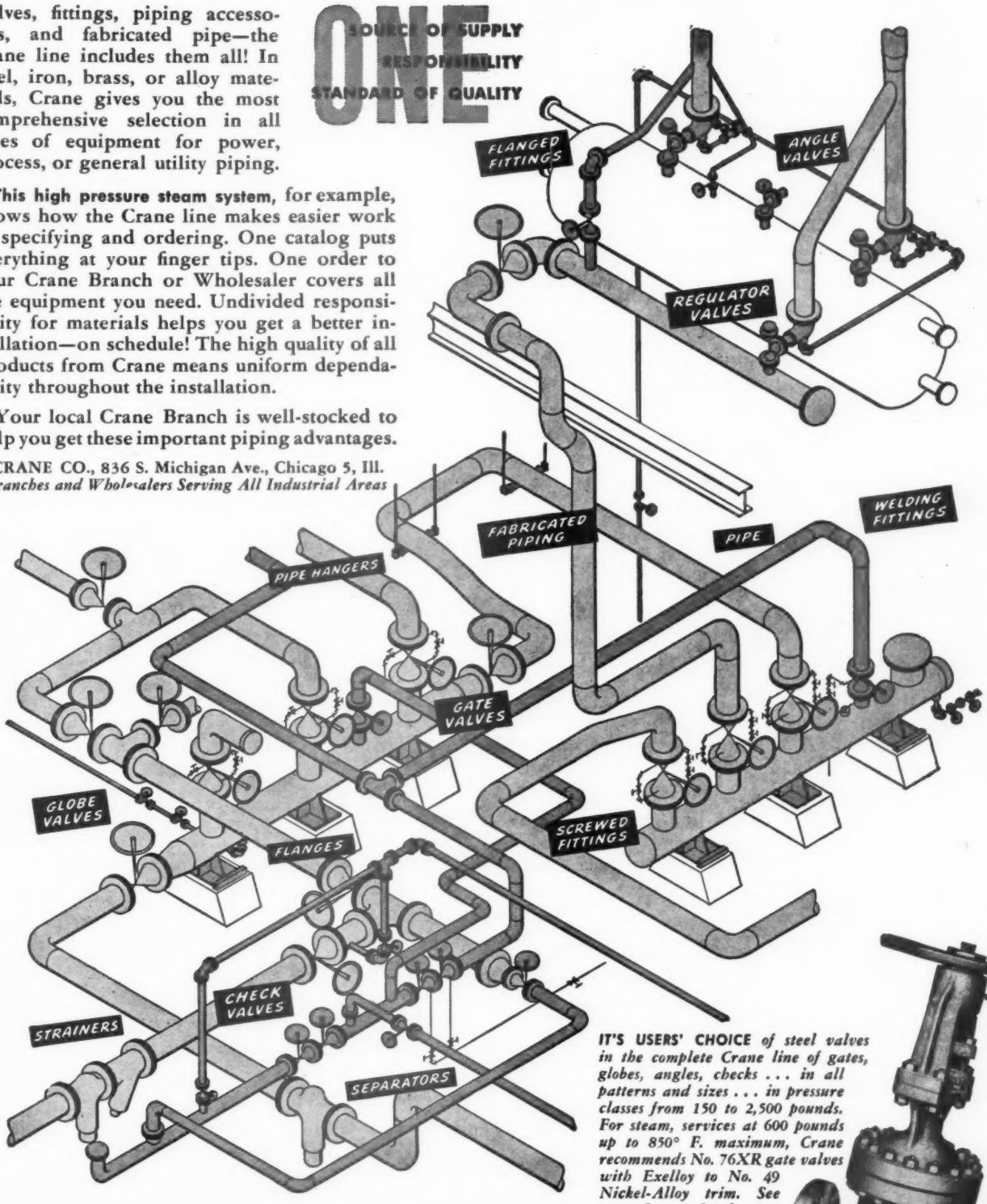

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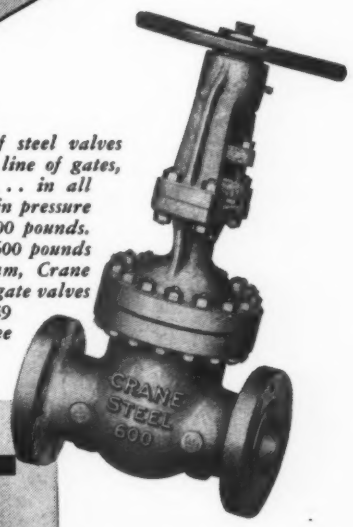

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THE INDUSTRY REPORTS

Below is a letter that could be written to the U. S. consumer by the U. S. oil and gas industry.

Dear Mr. Average Consumer:

You have a large stake in the operations and progress of the United States Oil and Gas Industry and we feel you should know how we are getting along. We shall try to tell you without using a lot of figures but we can't do it entirely without them.

You broke all records buying our products in 1947. You used 580 gallons during the year and we think you (and every person in the nation) will buy about 625 gallons in 1948.

Now this is a very large amount and it is keeping us hopping to fill your orders. Last winter we didn't get all the fuel oil you wanted to you in time and it may be touch and go on gasoline this summer.

We have a lot of good legitimate reasons for these slight shortages but we won't bore you with them. You will be more interested, we think, in learning what we are doing to meet your needs of petroleum products in the future.

In just two short years your oil industry is spending $7 billion to find more oil and gas and to modernize and expand plants, pipe line systems, tanker fleets, terminals, etc. That means we are spending $50 for every man, woman, and child in the United States so that you can get the oil products you want.

A large amount of this sum is being spent to find new pools of oil and gas. After we have been searching almost 90 years for oil in this country you can well understand that most of the easy to locate fields have been found. Now we have to drill very deep (we found 10 fields below 12,000 ft last year), try locations we have passed up before, drill over the water as in the Gulf of Mexico, or extend our search to foreign countries. We are doing all these things and they are all costly but results are what counts and we are getting results.

Another considerable portion of this $7 billion is being used to install systems that increase production of present fields. Plants are built in fields that remove liquid contents from gas as it is produced, then the gas is returned to the underground formation to maintain the pressure and thus increase the total yield of the pool. In other fields water is forced under pressure into oil-bearing formations to increase the flow of oil. These systems are expensive, also, but they mean the United States will produce more oil over a longer period than is possible without them.

Nearly all our refining capacity is being used and we need some additions, which we are building. Just as important is the modernization of the plants built before the war. Processing has changed and brand new improved methods are available that are more saving of crude oil and produce better quality products. You can see that we believe we can conserve raw material and still come out all right economically by installing the equipment for the modern processes.

We are also building a string of research laboratories from ocean to ocean for those research departments that are growing by bounds. They are making new instruments for use in finding and producing oil and gas; they are studying ways to make better products cheaper. No problem is too big and none is too little for those boys to tackle. A large number are working on the problem of making gasoline from natural gas, coal, and oil shale. We are spending millions on it and you will get the benefit of the results. You won't have to pay a share of the taxes that the government would need for the $9 billion program for synthetic oil products.

Last year one research department found an oil product that would help prevent nylon hose from running. All of them are busy trying to find how oil and gas can be found and used to give you a more comfortable and more pleasant life.

These are some of the things we are buying with that $7 billion. There are others like long pipe line systems, great terminals, and the largest ocean going tankers ever built by the industry.

Financing this size expansion program is a big job. Look at it! One industry in the United States with a program for property and plant additions costing about the same as the Marshall Plan.

First, we are financing about half of the expansion with profits. We had to charge you more for our products as you know. You didn't kick and we appreciate that. You must have understood something of what we were up against after the war. We had to make enough profit to build up our plant or you really would be enduring rationed shortages.

So far in the two-year period we appear to be making about half what we need for expansion and we are borrowing the other half. Everything is high in cost but we don't intend to wait around until deflation hits us to go into an all-out effort to fill your orders for petroleum products.

Thank you for your faith in us in the past and accept our assurance that we are building for a better future.

THE U. S. OIL AND GAS INDUSTRY.

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SCANNING WASHINGTON'S OIL HORIZON

By MILBURN PETTY

WASHINGTON—President Truman may make another attempt at obtaining legislation for priorities and allocations on critical materials, even though there is little chance that the Republican-controlled Congress will vote such controls before adjournment.

Privately, some Republicans agree that when the billions they are now voting for national defense are converted into planes, ships, and other armament, the resulting drain on critical materials will bring on some sort of priorities or allocations. But they believe that day is still so distant—not before next spring, anyway—there is no need for voting any standby controls now (certainly not until after elections).

Also, there are some people—and they include Republicans in Congress as well as some officials of the Truman Administration — who believe that the President has some inherent powers, perhaps holding over from the war, which could be utilized to control materials if that should become necessary before Congress comes back.

Meanwhile, the industry is going ahead, through the National Petroleum Council, with its program for obtaining additional steel under the voluntary allocations system under the Taft Law. Russell B. Brown (IPAA), chairman of the NPC steel committee, is confident that more steel is going to be available for oil and gas.

The steel requirements report by Brown's committee has made out a strong case for additional tonnage that has impressed government officials to whom it was submitted. Result is that oil and gas stand to get more steel under the voluntary program or under government allocations (which some steel men fear may be in the cards).

Analyzing the steel report, Max W. Ball, director of Interior's Oil and Gas Division, said "the overall amount of steel requested, if not more, will be required to furnish and distribute the full petroleum needs of the American public plus the minimum exports required in the national interest." (Ball's analysis was endorsed by Secretary Krug.)

But, Ball continued, "if the full tonnage requested cannot be furnished, fewer consumers will suffer from curtailment of some of the marketing items than from curtailment of those for production, refining or transportation, whether oil or gas, domestic or foreign."

Secertary Krug is one of Truman's advisers who feels that the Administration should push for allocations and priorities now. He believes that, with the American economy already operating at nearly full blast, it will be impossible to pile on the added demands for national defense and the European Recovery Program while maintaining the basic industries at full capacity and expanding still further, without the prompt exercise of priorities and allocations in the case of critical materials. If this is not done in time, according to Krug, the confusion, unbalanced inventories, and uncertain production that characterized early years of the last emergency will be repeated.

So Krug has recommended to Chairman Hill of the National Security Resources Board that immediate steps should be taken toward: (1) Restoration of RFC's wartime powers to build defense plants and acquire critical materials; (2) re-establishment of the industrial and materials divisions of WPB and other industrial mobilization agencies; and (3) enactment of priority and allocation powers over critical materials and supplies, and over construction activities.

The military has not yet completed its estimates of how much petroleum will be purchased during the fiscal year beginning July 1. One conservative estimate is that the figure will run 25 per cent above the current year's takings of 125,000,000 bbl. Taking into account the need for replenishing inventories, as well as the stepped-up training program, total military takings may go above 200,000,000 bbl. in the coming fiscal year.

This does not include estimates for the Marshall Plan (ERP), which, for the 12 months beginning July 1, are figured at 987,500 bbl a day of which 515,500 bbl a day is listed to come from non-dollar sources, 38,000 bbl a day from local production, and 434,000 bbl a day from dollar sources including 95,600 bbl a day from the U. S. and the balance from dollar sources in Latin America and the Middle East. Petroleum equipment, to be supplied from the U. S. during the same period, is figured at $226,700,000.

Middle East oil is regarded as "the pillar of the Marshall Plan." But the Haifa refinery shutdown, not to mention any other sore spots, has already started a refiguring of ERP supply sources, which may throw a greater burden on the Western Hemisphere.

Importance of having accessible sources in this hemisphere, in case of an emergency, is why the military continues to press the State Department to encourage development of Mexican oil resources (even though it be on Mexico's terms).

First Mexican deal announced was for development of a concession surrendered by Cities Service. No details were disclosed but it is understood that Cities Service is making up to $10,000,000 available to Petroleos Mexicanos in yearly advances, as a loan for development of this area in return for which the American company will get first call on 50 per cent of any oil produced there. If the parties should fail to agree on any year's budget, as proposed by Pemex, then the deal would be off from then on.

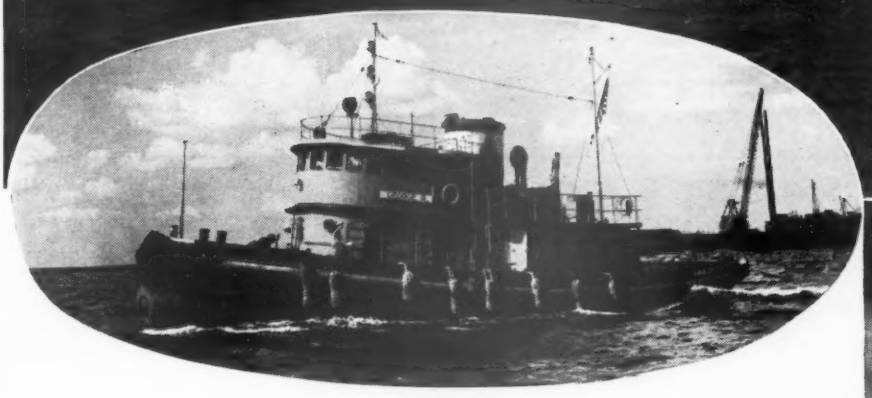
Meanwhile, despite the need for more oil and gas in the United States, about the only thing the industry can count on from Congress before adojurnment is another rash of oil investigations.

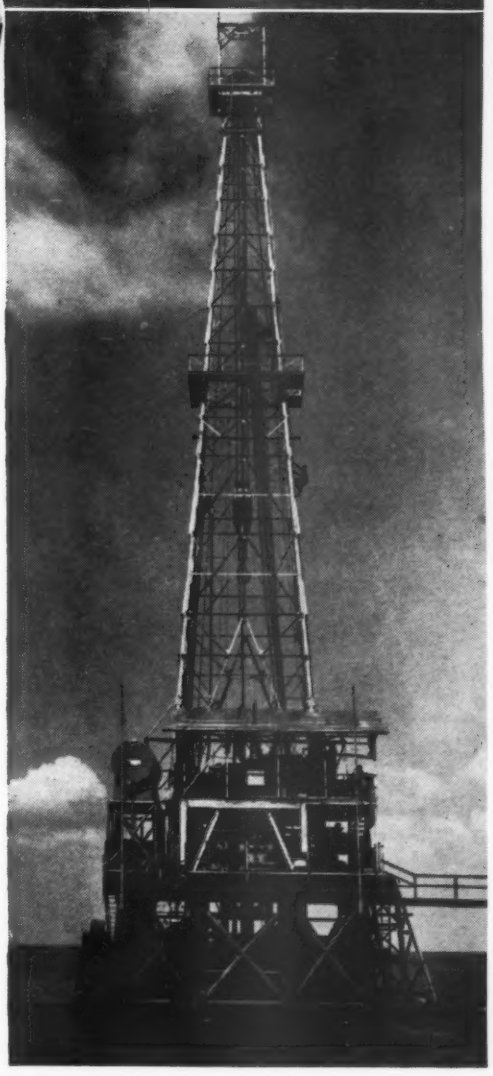
Chairman Brewster of the Senate War Investigating Committee, after a scathing attack on Arabian American Oil Company for "overcharging" the Navy on Middle East oil (which was denied by the Navy as well as Aramco), has bequeathed the committee's files to Senator Malone (Rep., Nev.) who now plans a summer-long oil investigation under auspices of the Senate Natural Resources Committee.

The Senate Small Business Committee, headed by Senator Wherry (Rep., Nebr.), continues its efforts to find products for independent marketers short of supplies and to get crude for independent refiners. But some of Wherry's approaches, such as proposed suspension of the Connally "Hot" Oil Law, have drawn fire from the industry.

Navy has been embarrassed in its request for $28,500,000 to carry on its Alaskan oil exploration program through 1953 by widely-published reports that "every seventh well drilled in the Alaskan petroleum reserve is a gusher." Since only three wells (one producing 25 bbl a day) have been completed there, Navy pointed out that such reports were premature. For the coming year, Navy's program is mainly to pick the best locations for drilling in the years following.

In the meantime, there still hangs over the industry's head the talk of "one or more big antitrust oil cases to be filed before elections." And the ideas range from pipe line divorcement to exclusive dealing at service stations.





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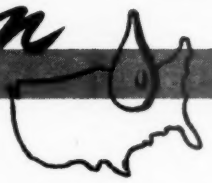
national petroleum situation



By H. J. STRUTH*,
Petroleum Economist

"TIGHT" SUPPLY OUTLOOK. While the industry is doing a remarkable job in meeting requirements for petroleum products and is confidently expected to supply consumer needs for gasoline as well as heating oils this year, the supply outlook will continue to be "tight" well into next year. Crude oil supply in the first 4 months of this year averaged 5,613,000 bbl daily, while demand was 5,602,000 bbl. daily. The surplus supply this year to date has been only 11,000 bbl daily, against a surplus in the first 4 months of 1947 of 96,000.

*Editor, *The Petroleum Data Book.*

DEMAND UP 8 PER CENT. Demand for oil in the first 4 months of this year is about 8 per cent above last year. Indicated demand was 6,275,000 bbl daily, against 5,864,000 bbl last year. Yet, due to greater imports of crude and products and maximum refining schedules the industry has managed to maintain supply within about one per cent of demand. Daily supply of all oils was about 540,000 bbl greater than last year, while demand increased 411,000 bbl. Projections of supply and demand through the first quarter of 1949 offer reasonable assurance that there will not be a shortage of gasoline this summer nor will the industry fail to provide next winter's heating oil requirements. Improved distribution of products this year may prevent spot shortages, but coordinated effort in allocation of supplies will be necessary to prevent them.

LOOK AHEAD. Studies of the supply and demand outlook through the first quarter of 1949, prepared by the writer as part of the study made by The Economics Advisory Committee of the Interstate Oil Compact Commission are:

(Condensed Summary—thousand bbl daily)

	1st quarter	2nd quarter	3rd quarter	4th quarter	Year
Demand					
1947	5917	5641	5765	6273	5900
1948	6365	6030	6070	6570	6265
1949	6575				
Supply					
1947	5630	5810	5946	6151	5886
1948	6175	6275	6325	6360	6285
1949	6390				
Stock change					
1947	— 287	+ 169	+ 181	— 122	— 14
1948	— 190	+ 245	+ 255	— 210	+ 20
1949	— 185				

Comparative Statistics, April, 1948

*All figures are computed on a Bureau of Mines' Basis**

	April 1948Ⓟ	March 1948Ⓟ	April 1947	This year to date	Last year to date	Per cent change
Wells drilling	4,480	4,400	3,750	4,480	3,750	+19
Total wells drilled	2,892	2,593	2,200	10,905	9,403	+16
Development wells	2,273	2,049	1,736	8,491	7,401	+15
Oil	1,587	1,488	1,173	6,044	4,938	+22
Gas	172	170	184	711	966	−26
Dry	514	391	379	1,736	1,497	+16
Per cent dry	22.6	19.1	21.8	20.4	20.2	+ 0.2
Service wells	160	159	132	681	546	+25
Wildcat wells	459	385	332	1,733	1,456	+19
Oil	57	55	64	234	223	+ 5
Gas	25	22	11	84	46	+83
Dry	377	308	257	1,415	1,187	+19
Per cent dry	82.1	80.0	77.4	81.7	81.5	+ 0.2
Crude supply*; Daily average	170,100 5,670	173,300 5,590	156,504 5,217	679,186 5,613	613,627 5,114	+11
Crude demand‡; Daily average	170,300 5,677	172,520 5,565	149,821 4,994	677,841 5,602	602,140 5,018	+13
Crude stocks; Days supply	232,000 41	¶232,200 42	241,663 48	232,000 41	241,663 48	− 4
Natural gasoline production; Daily average	11,800 393	12,150 392	10,753 358	47,291 391	42,141 351	+12
Motor fuel production; Daily average	72,800 2,427	71,200 2,297	63,374 2,112	285,330 2,358	256,464 2,137	+11
Gasoline yield, per cent	39.5	38.3	39.3	39.0	39.6	− 0.6
Motor fuel demand‡; Daily average	73,740 2,458	69,610 2,245	67,268 2,242	265,196 2,192	247,656 2,064	+ 7
Motor fuel stocks△; Days supply	107,560 44	¶108,500 48	98,323 44	107,560 44	98,323 44	+ 9
Fuel oil production; Daily average	69,700 2,323	73,630 2,375	57,363 1,912	286,705 2,369	237,473 1,979	+21
Fuel oil demand‡; Daily average	72,650 2,422	¶82,300 2,655	67,819 2,261	334,483 2,764	309,653 2,580	+ 8
Fuel oil stocks; Days supply	79,350 33	74,600 28	66,723 30	79,350 33	66,723 30	+19
Refinery still runs; Daily average	164,000 5,467	165,400 5,335	141,210 4,707	651,210 5,382	573,180 4,776	+14
All refined stocks; Days supply	260,500 43	¶256,700 42	241,641 43	260,500 43	241,641 43	+ 8

Supply and Demand—All Oils

	April 1948Ⓟ	March 1948Ⓟ	April 1947	This year to date	Last year to date	Per cent change
Total supply, all oils	188,200	191,800	173,220	750,972	679,921	+10
Daily average	6,273	6,187	5,774	6,206	5,666	
Total demand‡, all oils	184,600	193,100	171,184	759,276	703,711	+ 8
Daily average	6,153	6,229	5,706	6,275	5,864	
Change in stocks (total)	+3,600	−1,300	+2,036	−8,304	−23,790	

Current Crude Oil Prices

U. S. average	$2.61	Louisiana	$2.62
Texas	2.61	Arkansas	2.43
California	2.42	New Mexico	2.40
Oklahoma	2.63	Mississippi	2.42
Kansas	2.62	Illinois	2.76
		Other states	3.15

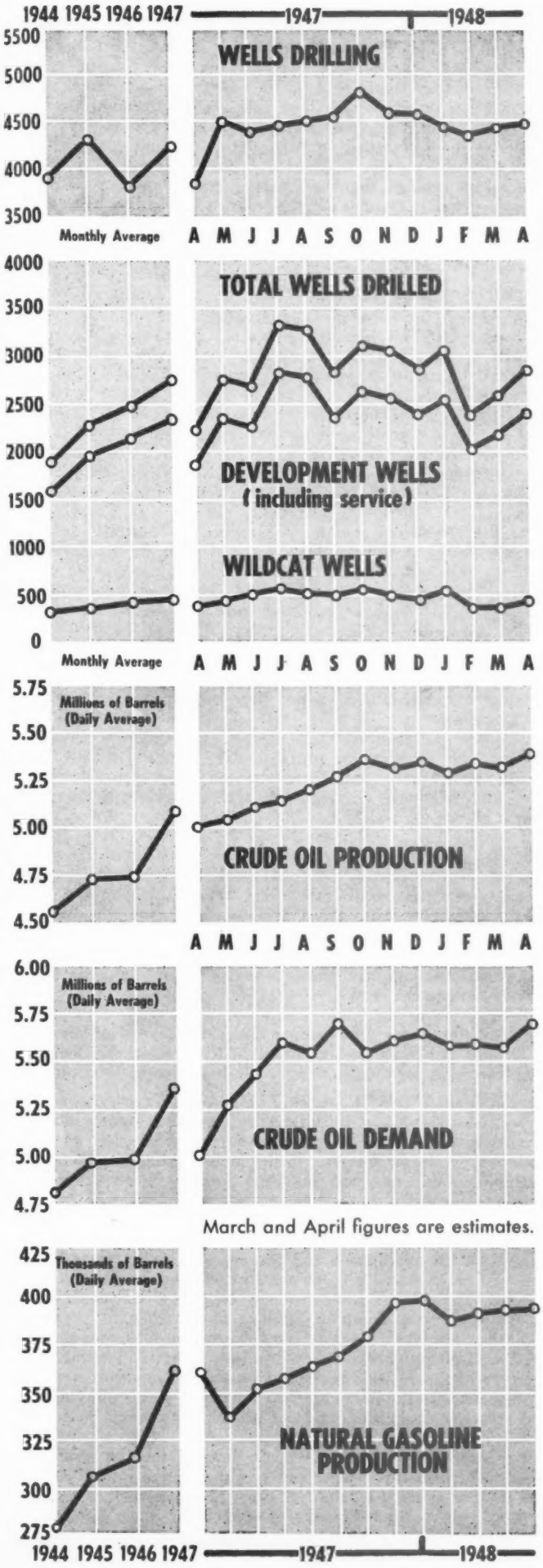
Basic crude prices:

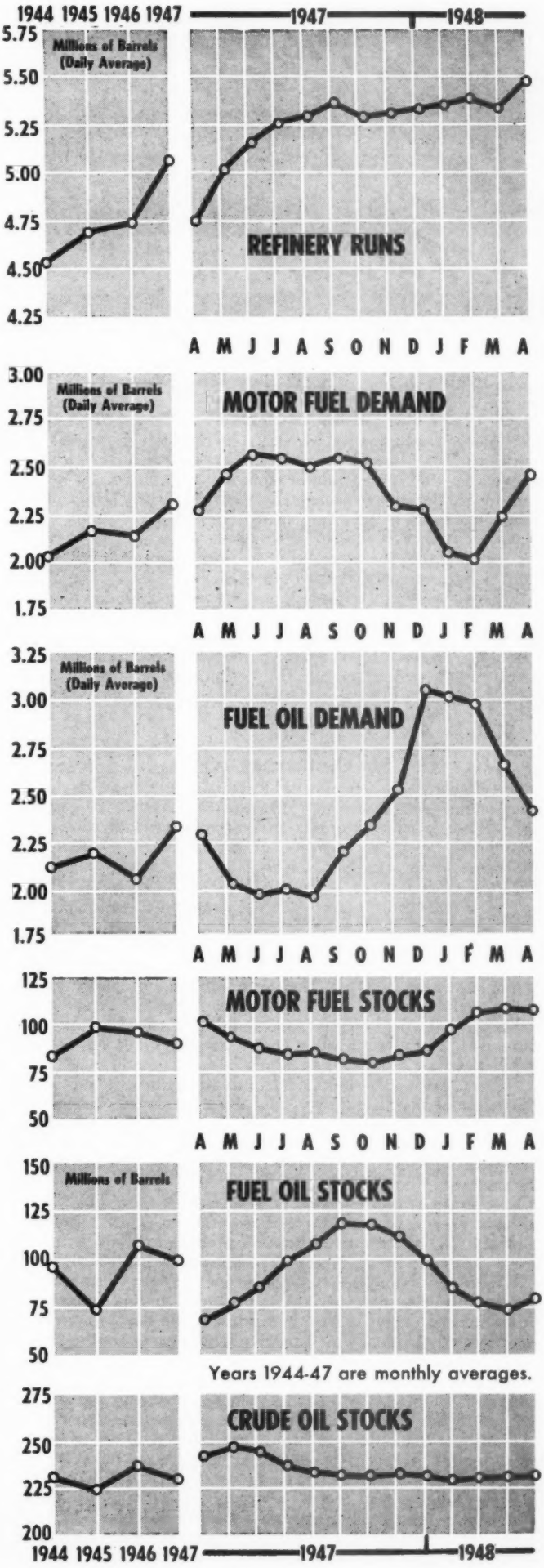
Oklahoma-Kansas (36 gr.)	$2.57
Texas Gulf Coast (36 gr.)	2.86
East Texas	2.65
West Texas (36 gr.)	2.44
California Signal Hill (26 gr.)	2.41
Pennsylvania, Bradford	5.00

Drilling and Production Statistics by States

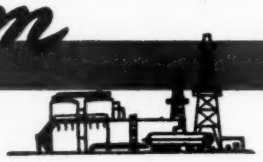
	April 1948Ⓟ	March 1948Ⓟ	April 1947	This year to date	Last year to date	Per cent change
Wells drilled (excl service)	2,732	2,434	2,068	10,224	8,857	+ 15
Arkansas	21	15	20	99	78	+ 27
California	252	204	160	885	610	+ 45
Illinois	115	126	134	568	592	− 4
Kansas	196	164	162	801	752	+ 7
Louisiana	178	156	102	601	391	+ 54
Mississippi	23	28	30	118	117	+ 1
New Mexico	54	55	42	201	175	+ 15
Oklahoma	317	278	263	1,189	1,233	− 4
Texas	975	851	637	3,433	2,726	+ 26
Other states	601	557	518	2,329	2,183	+ 7
Wildcats drilled (incl above)	459	385	332	1,733	1,456	+ 19
Arkansas	8	4	4	30	15	+100
California	33	20	36	104	112	− 7
Illinois	25	23	16	109	97	+ 12
Kansas	26	22	23	113	101	+ 12
Louisiana	19	20	18	75	75	0
Mississippi	5	10	3	30	25	+ 20
New Mexico	7	6	3	19	16	+ 19
Oklahoma	61	52	55	249	¶266	− 6
Texas	209	167	134	747	549	+ 36
Other states	66	61	40	257	¶200	+ 29
Daily crude production	5,390	5,316	4,974	5,335	4,841	+ 10
Arkansas	88	84	79	86	80	+ 8
California	942	940	906	936	899	+ 4
Illinois	173	170	186	172	189	− 9
Kansas	296	249	288	280	277	+ 1
Louisiana	473	471	429	473	421	+ 12
Mississippi	122	118	87	118	86	+ 37
New Mexico	130	130	107	128	105	+ 22
Oklahoma	397	399	380	397	374	+ 6
Texas	2,408	2,392	2,179	2,387	2,088	+ 14
Wyoming	145	145	117	142	112	+ 27
Other states	216	218	216	216	210	+ 3

*Unless otherwise stated all figures represent thousands of barrels. Ⓟ–Preliminary. •Includes domestic production and imports.
‡Total demand, including exports. △Includes finished and natural gasoline. ¶Revised.
Preliminary estimates based upon data supplied by American Petroleum Institute, U. S. Bureau of Mines, State Agencies, and other official sources.


1944 1945 1946 1947
1947
1948
WELLS DRILLING
Monthly Average
A M J J A S O N D J F M A
TOTAL WELLS DRILLED
DEVELOPMENT WELLS
(including service)
WILDCAT WELLS
Monthly Average
A M J J A S O N D J F M A
Millions of Barrels
(Daily Average)
CRUDE OIL PRODUCTION
A M J J A S O N D J F M A
Millions of Barrels
(Daily Average)
CRUDE OIL DEMAND
March and April figures are estimates.
Thousands of Barrels
(Daily Average)
NATURAL GASOLINE
PRODUCTION
1944 1945 1946 1947
1947
1948


1944 1945 1946 1947
1947
1948
Millions of Barrels
(Daily Average)
REFINERY RUNS
A M J J A S O N D J F M A
Millions of Barrels
(Daily Average)
MOTOR FUEL DEMAND
A M J J A S O N D J F M A
Millions of Barrels
(Daily Average)
FUEL OIL DEMAND
A M J J A S O N D J F M A
MOTOR FUEL STOCKS
A M J J A S O N D J F M A
Millions of Barrels
FUEL OIL STOCKS
Years 1944-47 are monthly averages.
CRUDE OIL STOCKS
1944 1945 1946 1947
1947
1948

highlights in oildom



● **TO STUDY ELECTRICAL LOGGING.** The Pennsylvania Grade Crude Oil Association has expanded its research agreement with the School of Mineral Industries, the Pennsylvania State College, to provide for a study of electrical well logging to be carried out under supervision of Dr. Sylvain Pirson, chief of the school's division of geophysics and geochemistry.

Objective of this project is to make electrical well logging a more useful tool for secondary recovery oil producers through facilitating correct interpretation of electric logs.

Successive objectives set up for the study include: (1) Determine the relative importance of diffusion, streaming, and thermodynamic potentials in the self potential curve; (2) evaluate the variables involved in the cementation and formation factors; (3) seek a quantitative relation of the various components of the self potential curve to either porosity, permeability, or pore size, and (4) investigate the differential effect of salinity and pH on the well fluid.

● **SUPPLY AND DEMAND REPORT.** Although petroleum supplies of record proportions will be available to the nation during the coming year, according to an official estimate, "the race to meet the enormous increase in consumption will be close," William R. Boyd, Jr., president of the American Petroleum Institute, said in making public a report of the Institute's National Oil Policy Committee.

The committee estimates the total supply of petroleum available to meet domestic consumption for the 12 months' period beginning April 1, 1948, will average 6,025,000 bbl a day, or approximately 8 per cent above the demand in the similar period beginning April 1, 1947. "But, even with this increase, supply and demand promise to be in delicate balance," Boyd stated.

This estimate is based in part upon the forecast of the U. S. Bureau of Mines that, for this period, imports of oil will average 102,000 bbl a day more than exports.

"If conditions outside its control do not retard the continued expansion of the oil industry," Boyd declared, "all former records will be surpassed by quantities of gasoline and fuel oil produced during the coming 12-month period, and, if the public will practice reasonable restraint, deliveries will probably meet the increasing demands."

In arriving at this estimate, it was assumed that: (1) "There will continue to be freedom from governmental interference or controls; (2) the excess of imports over exports will be at the levels estimated by the Bureau of Mines as of March 25, 1948; (3) there will be no major interference with the industry's expansion resulting from strikes or disasters, and (4) there will be no unusual delays or supply failures in the flow of materials, on order and planned, which are required to carry out the expansion programs during this period."

The committee believes that existing transportation facilities, plus new facilities that will be completed during the period, utilized to the maximum, will provide sufficient transportation to distribute the estimated supply availability shown in the report. Some of the present abnormal tank car movements, it is believed, will still be required.

Even though a breakdown in supply was avoided during the past winter, the race between unprecedented demand and record-breaking supply was so close that some spot shortages were unavoidable. It was found impossible, in some instances, to have the right amount of the right product at the right place at exactly the time needed. This past experience indicates that distribution problems become apparent whenever demand reaches 95 or 96 per cent of maximum supply capacity. It is the committee's opinion that the industry will be able to meet a normal increase of 4 to 5 per cent in demand during the coming summer-winter period without resorting to the various distribution expedients used last year.

Boyd emphasized that the shortage of steel pipe for the drilling of oil wells is causing great concern and unless more steel pipe becomes available to oil producers through regular channels the drilling program on which this estimate is based cannot be realized.

● **DRILLING MUD SCHOOLS.** Mud schools sponsored by the American Association of Oilwell Drilling Contractors have graduated 2594 oil industry men since inception of this educational program. The program was two years old in April. Currently running are schools at Long Beach, California, and Natchez, Mississippi.

Commenting on the success of the schools, John Woodruff, coordinator of petroleum industry training, University of Texas, reports that the graduates represent the product of schools held in nine states. Schools have been held in Texas, Oklahoma, California, Louisiana, Mississippi, Colorado, Illinois, and New Mexico.

The mud courses are designed primarily to train drilling crewmen in proper use and control of drilling fluids. They are open to employes of drilling contractors and producing companies. The training is one of several educational projects that the association is sponsoring in an industry-wide attempt to increase efficiency of operation.

● **CALIFORNIA WAGE RATES.** Daily wage rates for drilling and production employes in the California oil industry have reached a new high, a survey completed by Oil Producers Agency shows.

The survey, latest of a series that has been conducted by Oil Producers Agency for approximately 15 years, divides California oil companies into three classes: Majors, principal minors, and independents, and shows that in each group, prevailing wage rates are $1.50 to $2.00 per day more than they were last year.

It also shows that most companies have abandoned the practice of paying cost-of-living bonus, and have included the amount of the bonus in basic wage rates. This bonus, which amounted to approximately 10 cents per hour, accounts for part of the increases shown in basic rates, the remainder of the increase being the result of agreements reached between company employes and managements in discussions held about the first of the current year.

In addition to the basic rate, all majors, most of the principal minors, and a few independents, pay a shift differential of 6 cents per hour for the midnight to 8 o'clock shift and 4 cents per hour for the afternoon shift from 4 p. m. to midnight.

● **TO DEVELOP MEXICAN OIL RESOURCES.** The first contract between Mexico and a leading American oil company looking toward the development of oil resources of Mexico was announced by Senor Antonio J. Bermudez, director general of Petroleos Mexicanos, and W. Alton Jones, president of Cities Service Company.

Under the contract, Mexico-Cities Service Petroleum Corporation, a subsidiary of Cities Service Company, will provide capital for the exploration and development by Petroleos Mexicanos of more than 1,000,000 acres of oil lands in northeastern Mexico. These lands were formerly controlled by subsidiaries of Cities Service Company. Before a development program could be completed, the Mexican Government took over the operation of oil properties in 1938, but an exception was made in the case of these Cities Service concessions. They were held by agreement with the Mexican Government in status quo and the recent action is a culmination of negotiations over a period of time.

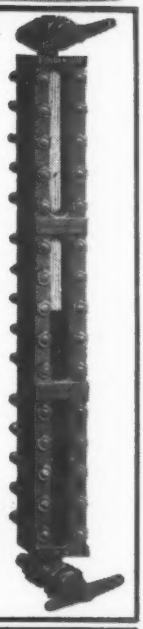
Exploration activities will begin immediately by Petroleos Mexicanos with funds advanced by Cities Service subsidiaries.

The area covered by the Petroleos Mexicanos-Cities Service contract are known as: (1) San Jose de las Rusias; (2) Sabino Gordo; (3) Buena Vista de la Papayas; (4) La Mision y Mogote, and (5) Santiago de la Pena.

PENBERTHY

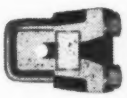
"REFLEX"

DROP FORGED STEEL LIQUID LEVEL GAGES



Liquid always shows black—empty space shows white. Preferred where the liquid level must be easily and positively visible, and when liquids are under high pressure or at high temperature. Made of alloy temperature resisting steel and are highest quality throughout. Liquid chamber made from solid block of steel to assure perfect alignment and rigidity. Conform with A.P.I.—A.S.M.E. requirements.

The "Reflex" is one of the complete line of Penberthy Gages that meet every liquid level gage requirement.

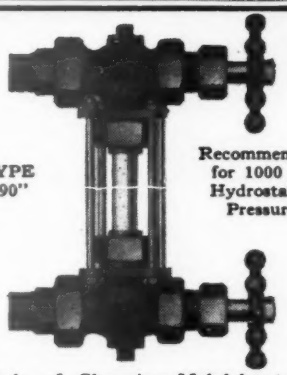


PENBERTHY INJECTOR CO.

DETROIT, MICH. *Canadian Plant* WINDSOR, ONTARIO

PENBERTHY

DROP FORGED STEEL LIQUID LEVEL GAGES



TYPE "90"

Recommended for 1000 lb Hydrostatic Pressure

Made of Chromium-Molybdenuin alloy temperature resisting steel, extra heavy throughout and stainless steel trimmed. Positive automatic shut-off; stainless steel balls shut off the flow of liquid if glass breaks. Regrinding removable seats, heavy duty stuffing boxes, union connections. Conform with A.P.I.—A.S.M.E. requirements.

This is one of the complete line of Penberthy gages that meet every liquid level gage requirement.

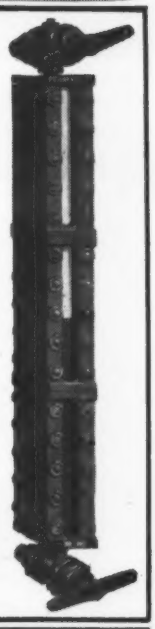
PENBERTHY INJECTOR CO.

DETROIT, MICH. *Canadian Plant* WINDSOR, ONTARIO

PENBERTHY

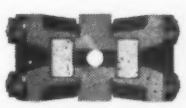
"TRANSPARENT"

DROP FORGED STEEL LIQUID LEVEL GAGES



Used to observe color and density of liquids under high pressures and/or temperatures. Construction exceptionally sturdy. Made of alloy temperature resisting steel, and are highest quality throughout. Liquid chamber made from solid block of steel to assure perfect alignment and rigidity. Conform with A.P.I.—A.S.M.E. requirements.

The "Transparent" is one of the complete line of Penberthy gages that meet every liquid level gage requirement.



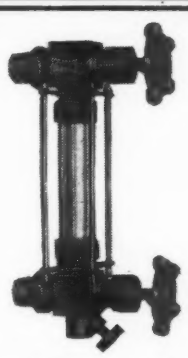
PENBERTHY INJECTOR CO.

DETROIT, MICH. *Canadian Plant* WINDSOR, ONTARIO

PENBERTHY

"ALL IRON"

LIQUID LEVEL GAGES



Body made from a special high strength alloy iron, shanks alloy steel and trim stainless steel. Extra heavy construction throughout, automatic and positive shut-off if glass breaks, heavy duty stuffing boxes. Conform with A.P.I.—A.S.M.E. requirements.

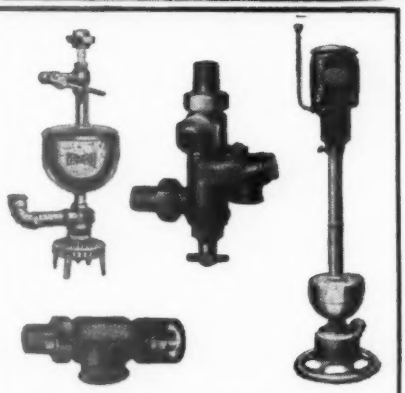
The "All Iron" is one of the complete line of Penberthy gages that meet every liquid level gage requirement.

PENBERTHY INJECTOR CO.

DETROIT, MICH. *Canadian Plant* WINDSOR, ONTARIO

PENBERTHY

QUALITY PRODUCTS



Penberthy injectors—ejectors—automatic electric and water (or steam) operated sump pumps are all widely used throughout the oil industry because they have always been dependable under the most severe service conditions.

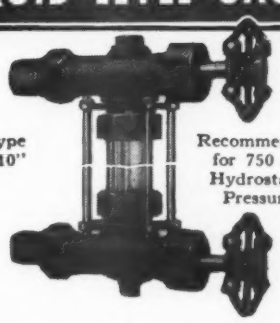
All are of rugged construction and made by an organization with 59 years experience in the manufacture of highest quality products.

PENBERTHY INJECTOR CO.

DETROIT 2, MICH. *Canadian Plant* WINDSOR, ONTARIO

PENBERTHY

DROP FORGED STEEL LIQUID LEVEL GAGES



Type "10"

Recommended for 750 lb. Hydrostatic Pressure

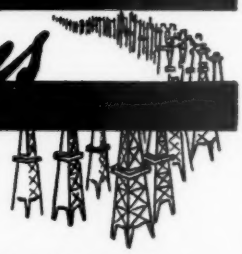
Steel construction throughout with stainless steel interior trim. Automatic shut-off is positive and instantaneous; stainless steel balls shut off the flow of liquid when glass breaks. Heavy duty stuffing boxes, union connections, offset construction facilitate cleaning and simplify glass replacement. Conform with A.P.I.—A.S.M.E. requirements.

This is one of the complete line of Penberthy gages that meet every liquid level gage requirement.

PENBERTHY INJECTOR CO.

DETROIT, MICH. *Canadian Plant* WINDSOR, ONTARIO

current oil field operations



Exploration wells that have found production.

● **NEVADA.** New Haven old water well at Good Springs, Clark. 10 BOPD 38° from 40 ft.

● **ILLINOIS.** Robinson-Puckett 1 Arthur Wood, w of Fairfield. Wayne. 25-min DST gas and oil Aux Vases 3192-202 ft.

N. Redwine & F. Strickland 1 Schuman W½ NW NW 14-1s-7e Wayne. Swb 250 BOPD Aux Vases 3141-49 ft.

Diamond 1 Toliver-Woods NE SW NW 15-4n-7e Clay. 125 BOPD Cypress 2602-16 ft.

● **OKLAHOMA.** Tom Palmer 1 Amerada SE NE NW 31-2n-5w Stephens. 500 BOPD Springer 10,040-42 ft.

Sinclair Prairie 1 Mays Morton NE NW SE 30-4-2w Garvin. 96 B 58.6° cond & 3146 MCF gas in 24 hr 7849 ft.

Falcon-Seaboard and L. W. Barrett 1 Bierman NE NW NE 30-13n-5e Lincoln. 198 BOPD from 4996 ft.

Stanolind 1 Marshall SE SE NW 9-7n-3e Pottawattomie. Swb 190 B oil in 2½ hr from 4519 ft.

Stanolind 1 Briscoe C NW SE 4-4-5w Grady. 245 BOPD Bromide 14,192 ft.

Sohio 1 Dunlap SE SW NE 17-1n-2w Eola, Garvin. DST 6000 ft oil from 10,643-717 ft. New sand.

Derby 1 Seltzer NW NW NE 15-28n-3e Kay. Oil show Burbank 3095-100 ft.

Continental 3 Hubbard NE NE NW 12-26n-2w. Hubbard field, Kay. 154 B oil in 24-hr Arbuckle 3667-3700 ft. New sand.

Falcon-Seaboard Drlg and Toklan 1 Yancey NE SE NW 26-14n-3e Lincoln. 15-20 BOPH Peru 4106-20 ft.

Skelly 1 Bombarger SW NE SE 12-13-7 Okfuskee. 162 B oil in 7-hr from 4039 ft.

Skelly 1 Cassidy NW NW NE 31-1s-4w Stephens. Swb 260 B oil in 6-hr from 6569 ft.

Cities Service 1 Boorom C NW SW NW 30-13-2w Oklahoma. 539 BOPD from 6268-78 ft.

● **ARIZONA.** W. D. Owens 1 Unit SE SE 27-23s-27e Cochise. Estimate 30 BOPD from 618 ft.

● **LOUISIANA.** Barnsdall et al 1 Breton Estate lse 1230, blk 36, Breton Sound, Plaquemines 2500 MCF gas daily 4160-68 ft.

Texas 1 Guidrez 51-17s-20e Valentine field, Lafourche. 30 B cond & 4860 MCF gas daily 11,042-90 ft.

Roeser & Pendleton 1 Lutcher-Moore 14-6s-13w Bancroft field, Beauregard. 135 BOPD 43.8° from 7744-46 ft. New sand.

Texas 5 State, Bay de Chene field, Jefferson. 210 BOPD 33.3° from 6862-78 ft.

● **KANSAS.** L. Wentworth and assoc. 1 Chambers 10-29s-2w Sedgwick. Bailed 250 BOPD Mississippi 3535-46 ft.

Pan-Handle 1 Hufford SW SW NW 33-21-13w Stafford. 368 BOPD Arbuckle 3770 ft.

Don T. Ingling 1 Miller SE SE NW 1-18-2w, McPherson. 858 BOPD Mississippian Chat 2851½ ft.

Westgate-Greenland 1 Ruth NE NE SW 13-18-1w McPherson. 317 BOPD Mississippian Chat 2829 ft.

● **COLORADO.** Suhr et al 1 Joe Miller SE NE SW 19-3s-66w, Adams. Oil from Hygiene at 5420 ft.

● **WYOMING.** Sinclair D-2, Wertz pool, Carbon-Sweetwater. 757 B 36° oil in 19-hr Madison 7185 ft. New sand.

● **TEXAS.** Ryan & Fullerton 1 Carrie McDonald, junction of Dockery, Mirando and Castello sur, Calhoun. 20-min DST 330 ft 44° oil Frio 9645-61 ft.

General American 1 A. F. Byrd 17-K, T. T. sur, Hale. 129 B 41° oil in 3-hr Upper Cisco 5830-95 ft.

Phillips 1 Weddell 72-M-GH&SA Schleicher. 2-hr DST gas & 30 ft oil 5620-80 ft; 2-hr DST 1220 ft oil 5690-740 ft.

L. M. Josey et al 4 Mitchell Estate S. Liberty, Liberty. 295 BOPD from 6111-46 ft. New sand.

Sun 1 Bossier, Taylor sur, Harris. 22 BOPD from 8155-57 ft.

Cities Service 1 Baker, V. Garcia sur. 1306 MCF gas daily 5240-49 ft.

Carl Hovgard 1 Lucy Goodwin 14-1-TN&O sur, Jones. 6 BOPD from 2298-307 ft.

Crader 1 Costello, M. Castleman sur-A-119, Palo Pinto. 1500 MCF gas daily from 1500-43 ft.

Oil Well Drlg. 1 Davis 36-12-T&P sur, Shackelford. 162 B oil in 12-hr Ellenburger 4693-715 ft.

J. H. Snowden & L. H. Freedman 1 Gober 3-DI&C sur-A-1265, Throckmorton. 597 BOPD Caddo 4464-69 ft.

S. B. Roberts 2 W. A. Minter NE 26-15-T&P sur, Jones. 62 BOPD from 2465-90 ft.

J. C. Hawkens 1-A Clark, Berry Smith sur, Coke field, Wood. 45-min DST 700 ft oil sub-Clarksville 4057-122 ft. New sand.

Sells 1 T. J. Taylor, Longwood extension, Harrison. Wet gas Travis Peak 6000-100 ft.

McCarthy 1 Fordyce, J. Hamilton sur, sec 53, Pierce Junction field, Harris. 351 BOPD 36.9° from 7282-88 ft. New sand.

Cities Service 7 Kariker, Nancy Fuller sur, Saratoga dome, Hardin. 248 BOPD Cerat at 5064-5110 ft.

Humble 1 Jim Johnson, Fulcher sur, Lee. DST 83 ft oil from 6319-24 ft.

Grubb & Hawkins 1 Rogers, sec 3, WCRR sur, Harris. 50 BOPD from 6198-211 ft.

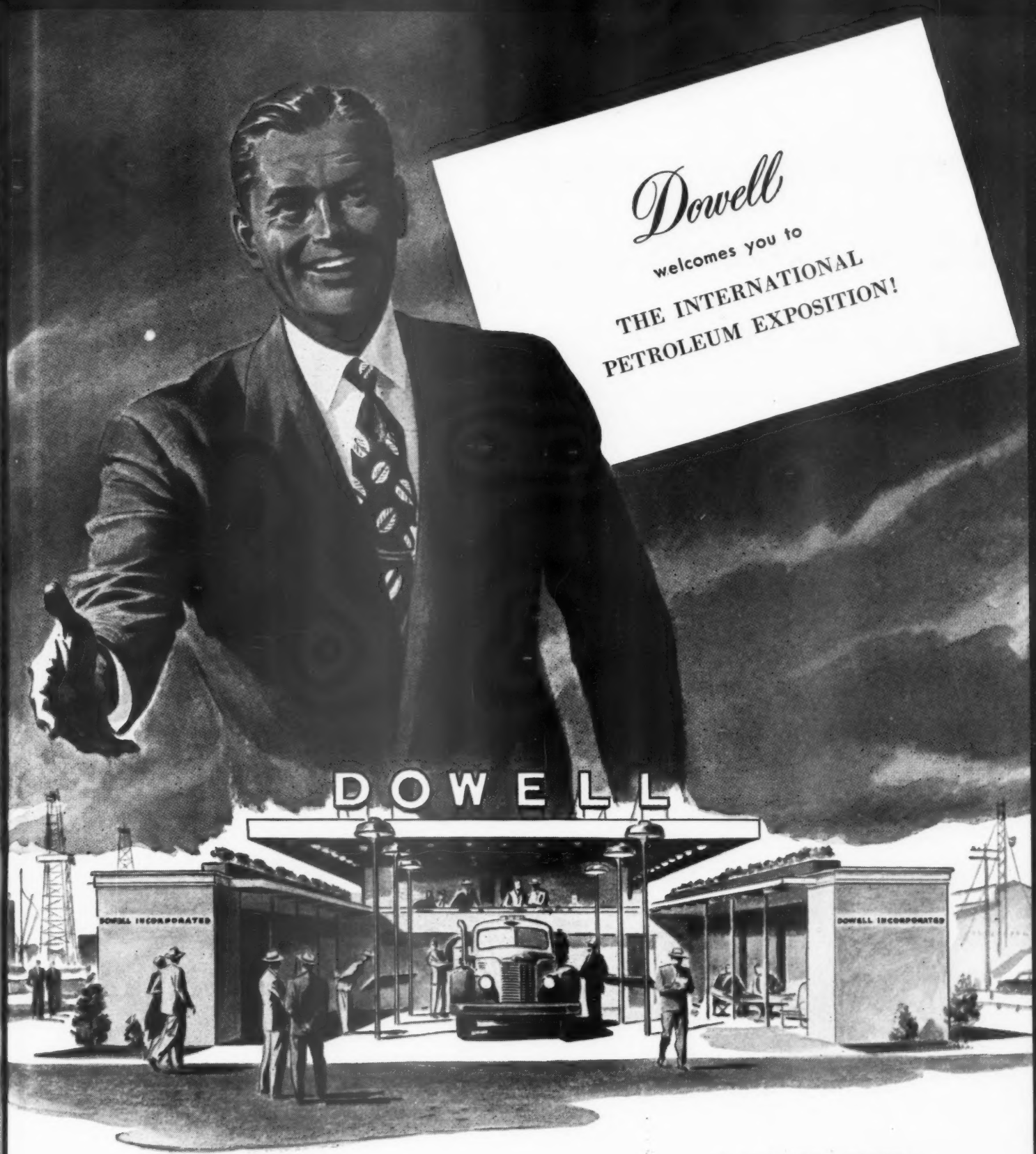
Star 1 Brown 2-2-BBB&C Callahan. Swb 6 BOPH Ellenburger 4462-87 ft.

Tex Harvey 1 Anthony 2-D&P Callahan. 8 BOPH Mississippian 3970-90 ft.

● **ARKANSAS.** Thombaugh 1 St. Francis County NE¼ NE¼ 8-4n-1w. Gas from Nacatosh.

Acme

First producing well in the Raman area, Turkey, spurts oil while President Ismet Inonu, Turkish officials, and American oilmen, who drilled the well, look on. Twenty wells are being drilled from Iskenderum to the Eastern Frontier.



See Dowell's Displays Explaining These Chemical Services for the Oil Industry:

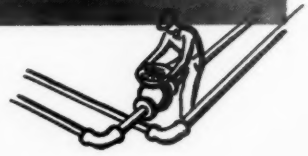
- *Acidizing Service* proved in thousands of successful well treatments
- *Electric Pilot Service* to reveal sub-surface well conditions
- *Plastic Service* used in many types of workovers
- *Chemical Scale Removal Service* for heat exchange equipment
- *Jelflake* for lost circulation problems, and time tested *Paraffin Solvents*

DOWELL INCORPORATED • TULSA 3, OKLAHOMA
SUBSIDIARY OF THE DOW CHEMICAL COMPANY

Be sure to visit Dowell's Building — opposite Drilling Inn. We'll be delighted to have you drop in — to look around—or to rest awhile.

DOWELL

pipeline developments



● **SOUTHERN NATURAL AND ATLANTIC GULF PLAN LINES.** Federal Power Commission set June 14, 1948 to open a hearing in Washington, D. C., concerning the applications filed by Southern Natural Gas Company and Atlantic Gulf Gas Company.

Southern Natural's amended application requested authorization to construct and operate a 24-in., 375-mile pipe line from the Gwinville field in Mississippi to Atlanta, Georgia, with extensions to LaGrange and West Point, Georgia, and Lanett, Shawmut, Langdale, Fairfax, Riverview, Alabama; a 16-in. trunk line extending about 225 miles from a point on the proposed 24-in. Gwinville-Atlanta line to the vicinity of Colfax, Georgia, with extensions to the areas of Tallahassee and Jacksonville, Florida, Savannah, Georgia and Georgetown, South Carolina; and compressor stations with an aggregate of 31,600 hp to be installed on the trunk and extension lines. Cost has been estimated at $43,625,895.

In its application, Atlantic Gulf Gas Company seeks authorization for construction and operation of approximately 1530 miles of natural gas transmission line and accompanying facilities extending from Mississippi through the southern parts of Alabama and Georgia, the northern part of Florida and southeastern South Carolina to terminate in the Georgetown, South Carolina, and Jacksonville, Florida, areas. Cost has been estimated at $57,126,000.

● **TEXAS GAS PROPOSES NEW BIG LINE.** Texas Gas Transmission Corporation has announced it proposes to build an 800-mile natural gas pipe line from Texas to a point near Middletown, Ohio. The initial cost of constructing the new pipe line is estimated to be $64,000,000.

It is expected that during the first year of full operation (the winter of 1949-1950), the new line will be capable of delivering about 275,000,000 cu ft of gas per day. Compressors will be added as needed until the ultimate capacity of the line of 400,000,000 cu ft per day is reached.

The company states that, "building of this new line is urgently required to increase the amount of gas available to the company's present markets and to help serve other markets in the Appalachian area that are dependent upon natural gas for fuel."

● **INCREASE OF CAPACITY AUTHORIZED.** The Federal Power Commission has made public orders (1) authorizing Tennessee Gas Transmission Company to construct and operate facilities to increase its delivery capacity to approximately 660,000,000 cu ft daily and (2) authorizing Hope Natural Gas Company to construct and operate additional facilities to increase to 200,000,000 cu ft daily the gas that it proposes to purchase from Tennessee Gas Transmission Company for further transmission and resale to present wholesale customers in the Appalachian area.

Facilities included in Tennessee's authorization are approximately 150 miles of 30-in. main line loop to be installed on its main pipe line and the addition of 10,000 hp to existing compressor stations. Cost of the project has been estimated at $11,739,500.

Under its authorization, Hope will add three 1000 hp units to its Cornwell compressor station and construct about 26 miles of 14-in. loop line to complete looping of a high pressure line between Cornwell and Hastings compressor stations. Cost has been estimated at $1,480,000.

● **EASTERN LINES PLAN EXPANSION.** Atlantic Seaboard Corporation and Virginia Gas Transmission Corporation propose to construct additional natural gas pipe line facilities. The Federal Power Commission will hear their application this month. Facilities are to include building approximately 269 miles of 26-in. gas transmission line extending from the vicinity of United Fuel Gas Company's Cobb compressor station near Clendenin, West Virginia, to a connection with the 20-in. main line of Atlantic at Rockville, Maryland, construction of 5 measuring stations, and enlargement of an existing station.

Portions of the pipe line in West Virginia and Maryland would be constructed by Atlantic and the portion of the line in Virginia would be constructed by Virginia Gas Transmission. The estimated over-all capital cost of the facilities has been estimated at $20,649,600, of which $14,873,975 would be borne by Atlantic Seaboard and $5,775,625 by Virginia Gas Transmission.

● **TENNESSEE GAS ASKS FOR HEARING.** The Tennessee Gas Transmission Company of Houston, Texas, asked the Federal Power Commission for an immediate hearing on its proposal for a $124,354,000 construction program, which will include laying a new pipe line from its present line at a point in Eastern Kentucky to Buffalo, New York.

The company previously had requested that the extension of this line be made to a point near Boston, Massachusetts. In the first amendment Tennessee Gas requested that FPC defer a hearing on the portion of its line East of Buffalo, New York, until the company can adequately serve customers in the Appalachian region and Ohio, Pennsylvania, and western New York already using natural gas. Later the line is to be extended to eastern New York State and New England, the company states, to add a new area to the system.

The application filed seeks to raise the system's through-put from its presently authorized capacity of 660,000 mcf daily to 1,000,000 mcf per day. This will include laying of 1461 miles of new pipe line and adding 91,200 hp of compression along the line. The pipe to be laid includes 992 miles of loop line, most of it 30-in., from South Texas to West Virginia; 395 miles of 26-in. line from Kentucky to a point near Buffalo, New York; 44 miles of 16-in. line from Columbiana County, Ohio, to a point in Allegheny County, Pennsylvania, and 30 miles of 16-in. gathering lines in the Southwest.

● **CONTRACT FOR RANGELY LINE GIVEN.** A contract to lay the 182-mile Rangely-Salt Lake City pipe line has been awarded to the low bidder, Pacific Pipeline and Engineers, Ltd., it was announced by C. E. Finney, Jr., president of the Salt Lake Pipe Line Company.

Finney said this was the principal unit in the construction project and will include all phases of the pipe line laying except the pumping stations. Estimated cost of the complete line is $5,000,000.

Actual purchase of the pipe, of which 168 miles will be 10 in. in diameter and 14 miles 8 in., is being handled by Salt Lake Pipe Line Company, Finney said. Fifty-four miles of pipe are on the way or have been unloaded. About 85 per cent of the shipments are being handled at two Utah points, Charleston and Park City, with the remainder being unloaded at Craig, Colo.

Finney said it was planned that Pacific Pipeline would start its preliminary operations next month. The line is scheduled to be in operation in November.

● **CANOL PIPE LINE TO TEXAS.** The pipe line used in the expensive Canal project landed in Houston, Texas, last month. The pipe traveled by steamship from Skagway, Alaska, to the port in the Gulf of Mexico. The much-sought-after pipe was welcomed by operators, who were glad to see the used but still quite usable lines.

The line was once laid from Norman Wells field to a refinery at Whitehorse, Canada. The whole project cost millions of dollars and caused a great deal of contention among Army, Congress, and oil men. Dismantled, the refinery was sold to Imperial Oil Company to be moved to Edmonton, Canada, and the pipe was shipped to Texas.

The tubing is 4 in. and 6 in. in diameter. From the ship it was loaded on trucks and railroad cars for distribution to pipe line projects, some of which are held up by pipe shortages.

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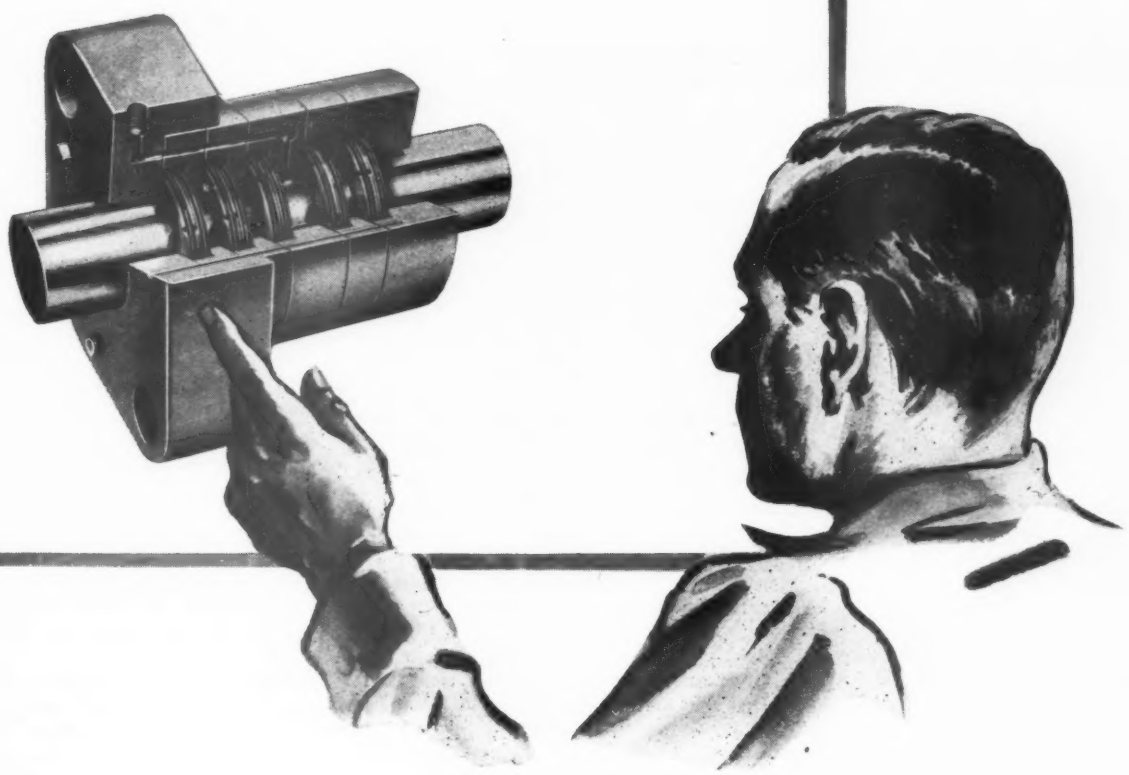

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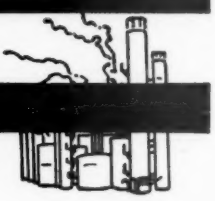


● **SOCONY AWARDS CONTRACT.** Socony-Vacuum Oil Company, Inc., has awarded the contract for general expansion and modernization of its refinery on South 20th Street in East St. Louis, Illinois to the Bechtel Corporation, San Francisco, California. The project, which will cost several million dollars, is scheduled for completion in August, 1949. Capacity of the refinery will be increased from 21,000 to 30,000 bbl per day. The work also consists of the rehabilitation and replacement, installation of floating roof storage tanks increasing the storage facilities by 50 per cent, or an additional 42,000,000 gal. There will be new thermal cracking units, naphtha reforming and distilling unit, and improvements to the terminal loading facilities.

● **EL DORADO UNIT TO BE ENLARGED.** W. G. Skelly, president of Skelly Oil Company, announced through James W. Vaiden, vice-president in charge of manufacturing, that a 30,000-bbl capacity crude distillation unit and a catalytic cracking unit of adequate gas-oil cracking capacity would be installed at the El Dorado, Kansas, refinery.

The crude unit will replace the existing 25,000-bbl capacity facilities and the catalytic cracking unit will augment the present thermal cracking equipment to provide a complete 30,000-bbl per day refinery to process the crude oil charged to its ultimate yield. The installation of these facilities is the final step in a plan of enlargement and complete modernization of the El Dorado plant that was begun in 1945.

The facilities, expected to be completed by January, 1950, will provide additional volumes of home heating oils, industrial burning oils, various grades of solvents, asphalts for highway maintenance and construction and motor fuel for private and industrial consumption.

Skelly's El Dorado refinery, in conjunction with the company's refineries at Longview, Texas, and Denver, and the company's 13 natural gasoline plants, will provide in excess of 40,000 bbl per day of refined petroleum products. The catalytic cracking facilities, recently improved from those installed during the war for the production of 100-octane aviation gasoline, will provide the means for producing motor fuels of much higher octane than those currently in use.

● **CHEMICAL PLANT IN OPERATION.** Jefferson Chemical Company announced that its plant near Port Neches, Texas, is now in full commercial operation. The plant manufactures ethylene glycol, ethelyne oxide, ethylene dichloride and other products.

The company was formed in November, 1944, by The Texas Company and American Cyanamid Company, but operates as an independent organization with its own technical and research, engineering, sales, accounting and general administrative departments.

● **TO INCREASE THROUGHPUT.** Crude supply of Continental Oil Company's Wichita Falls, Texas refinery will be increased by more than 6000 bbl daily by the construction of a new pipe line planned by the company in the North Texas area. At a cost of $150,000 Continental is building a 6-in. welded line from a point 3 miles east of the refinery to a distance of 16 miles eastward to the Ringgold-Joy sector of Clay County. Here the line will connect with the company's 4-in. line to southern Clay County. With a capacity of 12,000 bbl daily this line will practically double the system's capacity.

● **SALT LAKE REFINERY IN WORK.** The new refinery in Salt Lake City, Utah, is expected to be on stream by November, according to C. E. Finney, Jr., recently elected president of Salt Lake Refining Company.

Here is how Finney summarized the program:

Grading and fill for the main refinery installation already has been completed and spur trackage construction was begun last week by the Union Pacific.

A contract is scheduled to be awarded for the general fill job, which will involve movement of approximately 180,000 yards of material from the foot of adjacent hills, east of Highway 91.

Bechtel Corporation will build the main installation, consisting of a crude distillation unit, necessary boiler capacity and pipe lines connecting the tank racks and the processing units.

Tankage, with a storage capacity of more than 500,000 bbl will be constructed by the Chicago Bridge and Iron Company, the successful bidder. The tanks will be fabricated in CBI's Salt Lake City plant and all the steel will come from Geneva. A subcontract has been awarded to the Lang Company of Salt Lake City for fabricating columns, the main stack and some tanks and vessels.

A prime contract has been awarded the Morrison-Knudsen Company of Boise, Idaho, for construction of refinery buildings, including office and laboratory, locker and shop units. All subcontracting for such work as electrical, steel fabrication, plumbing, etc., will be on a local basis. Likewise, local contractors will be favored, wherever possible, on such items as grading, concrete work and road surfacing.

Future expansion of the refinery will depend on developments. The present unit, to cost more than $5,000,000, is regarded as the initial step of a long-range refinery program to serve the Intermountain region. The construction work will employ several hundred men, while the initial permanent refinery crew will be nearly 100. So far as feasible, local people will be hired and trained for these jobs.

The officers of the two companies, in addition to Finney are: Salt Lake Pipe Line Company, C. F. Hansen, vice president and R. W. Johnson, secretary-treasurer; Salt Lake Refining Company, T. S. Petersen, chairman of the board; W. W. Davison and F. C. Eastman, vice presidents, and R. W. Johnson, secretary-treasurer.

● **CHEMICAL PLANT IN PROSPECT.** K. S. Adams, president of the Phillips Petroleum Company, in Houston, Texas, last month with a large group of officials, announced plans to construct a multi-million dollar chemical plant on the Houston ship channel.

Adams revealed that his company plans to build a chemical plant costing between $6,000,000 and $10,000,000 in the Houston area. The oil company owns a 300-acre tract in Pasadena on the ship channel and has a small terminal there.

He said a decision on one or two chemical plants would be made within the next 30 to 60 days. The plant will turn out ammonium sulphite fertilizer for domestic and foreign shipment, he said. The compound is non-explosive.

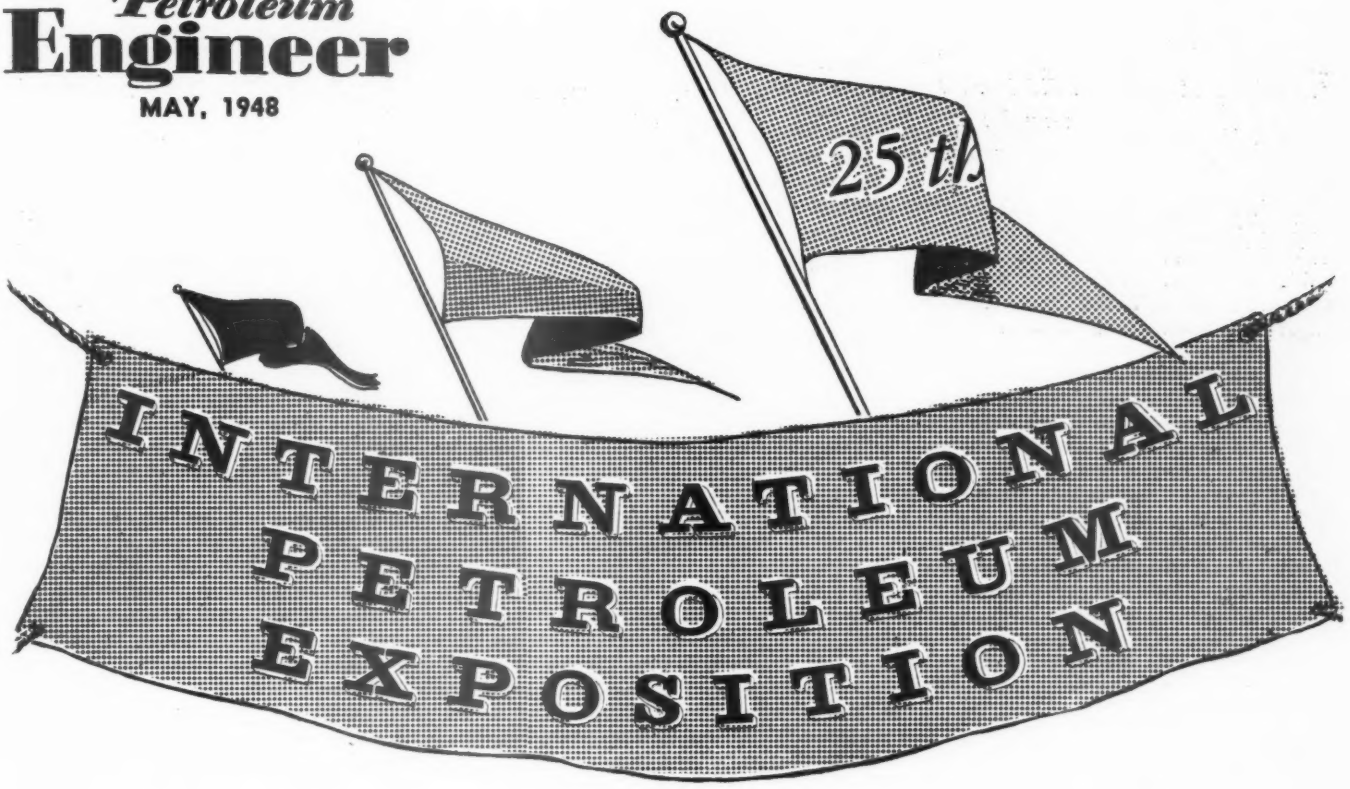
● **REFINERY SEIZED BY REBELS.** Tropical Oil Company's refinery at Barranca Bermeja remained in the hands of Colombian insurrectionists even after other Liberal Party rebellion activities ceased, according to reports from Bogota.

The only petroleum processing plant in Colombia, its seizure had immediate effects. It caused an acute gasoline shortage in Bogota, hampering transportation of foodstuffs. Rationing was put into effect and, at best, the reserves on hand would last only a few weeks. Gasoline could be imported from the Dutch West Indies but it would necessitate a long water and land haul and would not be immediately available.

All oil operations, except at Barranca Bermeja, are strictly production and not refining. A Tropical company spokesman said there had been no reports of insurrectionist activity against storage plants or production fields. A spokesman for the Shell Oil Company reported that company's producing fields unmolested.

The action presents a glimpse of the means that revolutionists can use for interfering with normal operations and indicates the paralyzing effect of any stoppage of petroleum products movement.

THE Petroleum Engineer
MAY, 1948



THE Silver Anniversary of the International Petroleum Exposition and Congress, which will open in Tulsa, Oklahoma, May 15 and continue through the 22nd, is the first Exposition since 1940 and, as such, will present the postwar offerings of oil equipment manufacturers. In point of number of exhibits and number of visitors, this is expected to surpass all presentations. The 1948 "Show" will bring together the latest and most complete collection of oil field equipment, methods, and processes ever assembled in one place, according to W. G. Skelly, president, and William B. Way, general manager. World-renowned business leaders and scientists are scheduled to address the Congress, which will be in session for three days beginning on May 18.

The Exposition will be opened formally on Saturday, May 15, at 10 o'clock.

Wm. R. Boyd, Jr., API president, Secretary of Interior Krug, and Sr. Berez Alfonso, Minister of Petroleum, Republic of Venezuela, will speak briefly.

The notables will be introduced by Gov. Roy J. Turner of Oklahoma and W. G. Skelly.

The band will play, flags of the 33 nations participating will be unfurled, aerial bombs will explode, and a national network will broadcast the "snappy" half-hour opening ceremonies of the World's Fair of the oil industry.

But with 1856 exhibitors waiting to do business in their own 15-acre plant with $100,000,000 in postwar machinery, equipment, and processes on display, oil show executives have no intention of making or listening to long speeches.

The Congress will be opened officially by Governor Beauford H. Jester of Texas, chairman of the Interstate Oil Compact Commission. May 18 also will probably be observed as Interstate Oil Compact Commission Day, according to Alf G. Heggem, chairman of the Congress.

Other internationally known speakers scheduled for addresses are the Honorable N. E. Tanner, Minister of Lands and Mines, Edmonton, Alberta, Canada; the Honorable Sr. Antonio J. Bermudez, general manager of Petroleos Mexicanos, Mexico City; Benjamin Fairless, president of the U. S. Steel Corporation, Pittsburgh; Charles Kettering, General Motors Corporation, Detroit, and Dr. Gustav Egloff, Universal Oil Products, Chicago.

Fairless is expected to discuss the steel situation and the outlook for allocation of more steel to the petroleum industry, a topic of vital importance to the oil business. Kettering is an acknowledged leader in research in the automotive industry, and the trend toward higher compression engines is of special interest to petroleum refiners.

Dr. Egloff is regarded as one of the best informed men in the industry on the manufacture of petroleum products, the development of new products, and on research that is making possible new insecticides, plant growth products, and other materials.

DIRECTORY OF EXHIBITS
begins Page 125
See insert for
Map of grounds and buildings

Heggem and his committee have contacted other industrialists and scientists in efforts to have them give addresses at the Congress.

Discussions of international personnel and public relations of the petroleum industry are planned for May 20 and consideration of future industry developments on May 21.

Sessions of the Congress will be of the open forum type. They will be held in the north and south auditoriums of Tulsa Central High School, Sixth and Cincinnati. Congress sessions have been confirmed as follows by J. Roy Inbody, assistant superintendent in charge of business service, Tulsa Central High School: Tuesday, May 18, 10:00 a. m. to 12:00 noon, south auditorium, 2:00 to 4:00 p. m. south auditorium; Thursday, May 20, 10:00 a. m. to 12:00 noon, south auditorium, 2:00 to 4:00 p. m., south auditorium; Friday, May 21, 10:00 a. m. to 12:00 noon, north auditorium, and 2:00 to 4:00 p. m., south auditorium.

The program, which calls for an opening forum on May 18 on international personnel and public relations of the petroleum industry, discussion of practical application of postwar processes and techniques on May 20, and consideration of future industry developments May 21 has been so widely endorsed it will probably stand firm, Heggem said.

Visitors to the Hall of Science will be able to peep in on one phase of Mother Nature's processes more than two miles under the surface of the earth.

In a special field laboratory truck provided by the U. S. Bureau of Mines station at Bartlesville, Oklahoma, temperature and pressure conditions 12,000 to 14,000 ft down will be accurately duplicated for visitors to observe, Dr. B. B. Weatherby, chairman of the IPE Scientific and Technical Committee, announces.

During actual field conditions the USBM lab truck is hooked into the oil well to be studied. As fluids, condensates, and gases come off the wellhead they are returned to the exact temperatures and pressures prevailing in the reservoirs. Fluid characteristics of the hydrocarbons produced from gas condensate reservoirs can thus be duplicated and studied as in their natural state.

The lab truck has water and cooling equipment and a power plant used to produce pressures up to 8000 psi. Fluids formed by this equipment are always viewed through periscopes focused on special glass windows because of such high pressures and temperatures.

Oil Industry Films

More than 50 of the finest oil industry films in the world are scheduled for regular presentation each day in the Hall of Science movie theater, Kent K. Kimball, chairman of the film committee, states.

Kimball said some of the first films to be booked on the oil theater's program are: "A New Frontier," courtesy of the Arabian-American Oil Company; "Oil for Tomorrow," produced by Interstate Oil Compact Commission; "Evolution," a geological picture filmed by the American Museum of Natural History, New York, and "Oil from the Earth," made by the British Information Service, London. These are only a few of the 100 or more outstanding sound films that will portray the "story of petroleum," in all its phases.

Films will contain information on the war and postwar progress of processes and equipment for exploration, drilling, production, transportation, refining, and marketing of oil. The laying of pipe lines and their importance within our country and abroad will also be shown.

Foreign Delegates

That the Exposition is truly international in scope is attested by the fact that more than 500 foreign delegates are expected. The latest available list of foreign visitors includes the following:

Africa: John B. Wiel, George E. Failing Supply Company, Johannesburg; Mr. Caron, Unit Rig and Equipment Company, Algeria; Michael Tenaille, Syndicat d'Etudes et des Recherches Petrolieres, Algeria; Mr. de Reure, Societe Cherifienne des Petroles, Rabat, Morocco; Mr. Guilhaudis, Syndicat d'Etudes et des Recherches Petrolieres, Algeria; Mr. Tarranger, Societe Cherifienne des Petroles, Rabat, Morocco; Mr. Gadouleau, Societe Cherifienne des Petroles, Rabat, Morocco, and Mr. Iltis, Syndicat d'Etudes et des Recherches Petrolieres, Algeria.

Argentina: Glenn W. Hamilton, Cardwell Manufacturing Company, Buenos Aires; E. P. Canepa, George E. Failing Supply Company, Buenos Aires; Hector A. Gonzalez, General Ramon 9. Albarino, president of Y. P. F., Ing. Alberto Landoni, I. J. Teitelbaum, Jorge Harguindey, all of the Argentina Government, Buenos Aires; A. D. Bolland, manufacturers' agent, Buenos Aires, and Kenneth S. Langley, Langley & Cia., Buenos Aires.

Asia: James Herriek, Cardwell Manufacturing Company of Asia.

Brazil: General Joao C. Barreto, Dr. Leopoldo Miguez de Mello, Gilberto Franco, Dr. Antonio S. Moggi, Dr. Pedro de Moura, National Petroleum Council, Rio de Janeiro, and Dr. Carlos E. Paes Barreto, National Petroleum Council, New York City; Dr. Romeo Marquez, Drilling and Exploration Company, Rio de Janeiro, and W. W. Anderson, president, Standard Oil of Brazil, Rio de Janeiro.

Canada: N. E. Tanner, minister of lands and mines, Alberta; B. A. Myers, P. W. Lambright, H. P. Palkowsky, John Hall, D. J. Vandemeer, R. E. Moyar, H. H. Bybee, G. E. McLean, A. L. Wilson, T. Taber, and K. Turner, all of International Petroleum Company, Toronto; W. L. Quarti and N. J. Cantwell of Drilling Supplies, Ltd., Calgary; L. Baron and Jack Baron of George E. Failing Supply Company, Toronto; W. E. Kleinsteiber, J. K. C. Brown, M. L. Haider, W. D. C. MacKenzie, C. Viesser, G. D. Wright, E. D. Wilson, Rex L. Dawson, J. D. Gustafson, L. C. Stevens Guille, and R. E. C. Wade, all of Imperial Oil Limited, Toronto; K. H. Houston, J. G. Trowell, F. Beckhardt, and F. C. Galloway, of Royalite Oil Company, Toronto; E. F. T. Stevens and W. Ashcraft, Madison Natural Gas, Toronto; O. B. Males, Refinery Division, S. F. C. L., Regina, Saskatchewan.

Chile: F. Salas, Chilean Government, New York City; Luciano Claude, E. Simeon, A. I. Carney, C. N. Strong, and E. Fabres, all of the Chilean Government, Santiago; George P. Livermore, Inc., drilling contractor, Punta Arenas.

Colombia: A. F. Eadie, W. F. Parraga, and C. M. Potter, Richmond Petroleum Company, Bogota; E. J. Richards, Cia. Shell de Colombia, Villavicencio; M. D. Brown, J. L. Edwards, M. H. Hull, R. W. Lynch, R. E. Trammell, S. L. Slaughter, W. L. Little, D. P. Murphy, R. V. Welch, P. R. Ratcliff, and M. M. Brisco, Tropical Oil Company, Bogota.

Egypt: H. C. Gull-dge, M. Schweizer, Charles F. Gaulke, and O. A. Seager, Standard Oil Company of Egypt, Cairo.

England: Niels Matheson and Cyril F. Dennis, British Oilfields Equipment Company, S. W. I.; A. Fisher, E. M. Fones, and Jack Mitchell, George E. Failing Supply Company, London; A. G. Ellison, The Yorkshire Copper Works, Ltd., Leeds; L. S. Dawson, The Oil Well Engineering Company, Stockport; Charles I. Kelly, petroleum consultant, Ilford, Essex.

Europe: Srecko Kajfez, European representative.

France: L. Cauchois, S. N. des Petroles D'Aquitaine, Toulouse; G. Feger, S. N. des Petroles D'Aquitaine, Pau; F. Emmanuelli, L. Valat, and M. J. Pellion, S. N. Marep, Paris; Jean Mothre, Regie Autonome des Petroles, St. Gaudens; M. Barthe, Forex, St. Gaudens; Olof V. Linqvist, George E. Failing Supply Company, Paris; M. Maratier, Forex, St. Gaudens.

Mexico: Antonio J. Bermudez, Miguel Quiroz, Javier Luna, Jose Dominguez Marquez, Leopoldo Coronado, Vincente Fuentes, Armando Moran, H. Huber, Donato Estrop, and Antonio E. Castellot, all of the Mexican Government, Mexico City; J. M. de la Garza, George E. Failing Supply Company, Mexico City.

Netherlands: Groenix Van Zoelen, K. L. M. Royal Dutch Airlines, New York City.

Panama: Dr. Manuel Jesus Quijano, minister of the treasury, Panama City.

Poland: George Jaczewski, Polish American Supply Corporation, New York City.

Peru: W. K. Kirby, Ganso Azul Oil Company, Lima; H. W. Grimes, Cecil Alworth, J. E. Lewark, and R. J. Waldram, International Petroleum Company, Lima; E. C. Breene, R. A. Ratcliff, W. B. Hayes, I. H. Hughes, and N. R. Stewart, International Petroleum Company, Talara.

Russia: V. T. Mamrykin, P. A. Levashov, A. A. Bodanov, A. T. Serdukov, and N. N. Kalmycov, Amtorg Corporation, New York City.

Trinidad: W. H. Busold, Trinidad Leaseholds, Inc., New York City; E. R. Gransaull, Trinidad Leaseholds, Inc., Forest Reserve; T. U. Bower, Trinidad Leaseholds, Inc., Pointe-a-Pierre; H. A. Nicolls, Foster Lease Service, Port of Spain; R. Fahey, Antillas Petroleum Company, Port of Spain; Alvin Tucker, Industrial Agencies, Ltd., San Fernando.

Turkey: Ihsan Ruhi Berent, Turkish Government, Angora.

Uruguay: C. R. Vegh Garzon, Ezeguiel Pirez Prins, and Tochetti Lespade, Uruguayan Government, Montevideo.

Venezuela: Lawrence Cade, W. E. Brown, M. Muller, R. D. Moriarty, Siro Vazquez, and Charles A. Hall, all of Creole Petroleum Corporation, Caracas; Joe R. Love, Creole Petroleum Corporation, Maracaibo; C. N. Willbanks, Creole Petroleum Corporation, Jusepin; Dr. Jose Martorano Battisti, Venezuelan Government, Caracas; Arthur Maddox, International Petroleum Company, Caracas; H. B. Weaver and Ray Johnson, Mene Grande Oil Company, Caracas; J. L. Adams, Mene Grande Oil Company, Barcelona; Dr. Carlos Perez de la Cova and Earl Griffin, Phillips Venezuelan Company, Caracas; K. L. Gordon, Kidd Gordon, and Dana Champion, Richmond Petroleum Company, Caracas; Mr. Dahlgren, Socony-Vacuum Oil Company, Inc., Caracas; A. C. Beall, S. P. Kent, and I. N. Stephenson, Texas Petroleum Company, Caracas; F. W. Turner and A. W. Finch, Venezuelan Atlantic Refining Company, Caracas; M. R. Conger, manufacturers' agent, Caracas; George Marsh, Cardwell Manufacturing Company, Caracas; R. H. Hume, Consolidada de Petroleo (Sinclair), Caracas; and E. H. Delmas, Consolidada de Petroleo (Sinclair), Santa Barbara.

★★★

Electric power for gas transmission

By W. H. STUEVE, *Mechanical and Electrical Engineer,*
Oklahoma City, Oklahoma

EXCLUSIVE

THE use of natural gas for domestic and industrial purposes has replaced practically all other forms of fuel in the Southwest, with the exception of some rural areas, and now is becoming a major source of fuel supply in the East, where this form of fuel has been almost wholly depleted, leaving little dependable capacity available.

Many pipe lines are being projected and older lines are being "looped" in order to increase capacities to the East, whose primary source of supply lies in the Southwest states of Texas, Oklahoma, Kansas, and Louisiana. These states contain within their boundaries almost three-fourths of all the gas reserves in the United States, but consume only about one-half of their own production, leaving almost 2 trillion cu ft available for export per year. With the delivered cost of coal and oil reaching all time highs since the close of World War II, the large industrials and gas suppliers are looking with envious eyes to the Southwest to obtain natural gas to replace former solid fuels, or to augment their present sources of gaseous fuel supply.

For many years the gas transmission industry has followed a conventional pattern of installing reciprocating compressors, driven by gas engines in the booster stations, operating at compression ratios of 1.6 to 2.0, with stations being spaced from 80 to 120 miles apart. Apparently little thought was given to using other forms of power, closer station spacing, rotating machinery, or higher initial working pressures, although the oil industry recognized this problem more than 20 years ago.

It cannot be said, however, that the natural gas transmission industry has been dormant all these years, because in 1931 an experimental centrifugal unit was installed in Kansas on a main pipe line serving Kansas City, which originated in the Hugoton field of southwest Kansas. This unit consisted of a 3000-hp, 3600-rpm motor driving six stages of centrifugal blowers, all self-contained in a cylindrical housing with dimensions of about 25 ft in length and 5 ft in diam, being designed for outdoor installation, mounted on a simple concrete pad. The suction gas was taken in one end of the cylinder and passed around the stator coils of the motor supposedly for the cooling effect, and then passed successively through the six stages of the centrifugal blowers. The discharge was taken from the side of this cylindrical housing. Observations made in October, 1931, at the installation at El Dorado indicated the adiabatic efficiency was approximately 65 per cent when delivering 88 million cu ft a day, when the suction pressure was 211 psia, 68 F, and discharge pressure was 292 psia, 130 F, and resultant R 1.38. The cost of this experimental unit complete with transformers, switch gear, and piping, was about $120,000, or $40 per hp. The discharged gas was not after-cooled before passing into the pipe line.

For some unaccountable reason, further field experimental work was not followed up with this unit, but later developments indicated "loops" were being installed to gain increased capacity, since some difficulty was encountered in the original design. Wet gas passing around the motor coils caused deterioration and ultimate breakdown of some of the windings. The basic centrifugal principle, however, remained alive and most of the future research work was centered on developing a shaft seal to eliminate the compact cylindrical housing that contained both the motor and the centrifugal blowers.

In the meantime, rotating machinery for pumping natural gas was being used in West Virginia for gas gathering lines. These units were of the rotary type with the rotating element set on eccentrically and axial sliding vanes accomplishing compression. Working pressures of only three or four atmospheres were utilized. Electric motors were used as prime movers to be actuated with mercoid automatic pressure control. Motors as large as 100 hp, to handle some 2 or 3 million cu ft a day, were employed.

Practically all centrifugal blower manufacturers, except one, refrained from offering equipment to operate against the higher working pressures of 500 to 800 psi, ordinarily employed in main gas transmission lines. This one manufacturer, however, continued to develop the shaft seal and after considerable research was in position to offer equipment at the time the "Big Inch" pipe lines (24 in. and 20 in.) were offered for sale by the War Assets Administration in early 1946.

These pipe lines were constructed during the war to deliver oil and/or oil products from Texas to the Eastern Seaboard, but were destined to be used for gas deliveries at the close of hostilities, because the oil industry had amassed a sufficient number of tankers during the latter phases of the war, so that the Big Inch lines, as oil carriers, would no longer be required in peace time. The physical manner in which these lines were constructed, the station spacing, and the availability of sufficient electric power every 50 miles, made the use of electric-driven centrifugal compressors a distinct possibility.

As stated previously, the gas transmission industry had always accepted line design compression ratios of about 1.8, along with station spacing of about 100 miles, as the most economic arrangement for its purposes. Yet very complete studies of the economics of gas pumping had been made, indicating that closer station spacing with consequent lower compression ratios might prove more beneficial, in that great savings could be made in invested capital, since the required horsepower installed could be reduced in the order of 25 to 40 per cent.

In following up these economic studies made some years ago, the use of electric power was not generally given much consideration:

First, because the power costs in general were considered too great.

Second, electric power in sufficient amount would not be available at some of the remote station locations, and highline extensions were too costly.

Third, the continuity of power service was considered not good enough.

Fourth, at that time the investment in the electric type of station—synchronous motor-driven reciprocating compressors—was too great.

Fifth, the studies were usually based on achieving high capacity factors of 100 per cent.

Sixth, it was felt that the constant speed electric motor did not provide sufficient flexibility for capacity changes.

Most of the answers to these apparent disadvantages of the electric drive were found in the experiences of the constructors of the Big Inch pipe lines, and also from the guarantees as of today of the lone manufacturer of centrifugal compressors. In the following discussion, an attempt will be made to portray the known facts concerning the possible use of electric power by the gas transmission industry, in the order given above.

● **Power rates.** A review of the electric power rates negotiated for the Big Inch lines gives a fairly good cross-section of the rate schedules offered by the power suppliers in passing through 1200 miles of farming and industrial territory of our country—Texas to New Jersey—and, therefore, the value obtained could be construed as representative of conditions to be found most anywhere in the states. Power contracts were negotiated at 34 locations in sizes of 3750 hp to 8250 hp to be served by 20 electric utilities. The weighted average rate

offered for the 250,000 hp of pumping units was 0.65 cent per kwhr at 100 per cent load factor, 0.71 cent per kwhr at 80 per cent, 0.9 cent per kwhr at 50 per cent monthly load factor. In most cases the only method by which these power schedules could be increased was through the application of fuel clauses during the contract period. If fuel costs throughout the length of the lines were to be increased as much as 50 per cent, the net increase in power costs would be only about 13 per cent. The usual capacity guarantee was 50 per cent, so that if the load fell off half during any month from the contract capacity, usually it was possible to earn the 100 per cent load factor rate if continuous steady load were maintained. In practice during two years' operation of the Big Inch lines the power costs averaged 0.69 cent per kwhr, with electric load factors averaging 90 per cent.

● **Availability of sufficient electric capacity.** In general, electric power suppliers will spend about 1½ to 2 times the annual expected revenues to supply a given pump station or industrial load. A horsepower of installed equipment, when operated at a reasonable load factor, will produce about $50 per year in revenue. As an example, a 5000-hp (4000-kw) station for gas pumping will produce about $250,000 in annual revenue, which should permit the expenditure of $300,000 to $400,000 on a long-term (10 year) contract. This much capital investment would readily construct 40 to 50 miles of high voltage power lines (33 to 66 kv) and also cover the cost of the step-down substation for delivery of 2400 volts at the pump station site. The average length of line constructed to serve the 34 locations on the Big Inch lines was only 11 miles, even with locations being principally in rural country. It would appear that most station sites selected could be served somehow, and the expenditures would be justified on a sound business basis.

● **Continuity of electric service.** A study made of electric service supply, after the Big Inch stations had been in operation almost two years, revealed the actual shut-down time, due to power failures, of the 26 stations on the 24-in. crude line was only 0.90 per cent of total elapsed time, and for the 29 stations on the 20-in. products line the time lost because of power failures was only 0.12 per cent of the total operating time. These "lost-time" figures also included time lost due to electric equipment failures. Standby units were not installed in any of the stations, and this decision proved satisfactory based on the performance record. Almost half of the stations served were in territories having a preponderance of heavy lightning storms, as compared to other sections of the country, as generally recognized in electric utility circles.

● **Investments in pump stations.** A few years ago, when an attempt was made to interest the gas transmission people in using electric motors in their operations, the cost of such electric compressor station was estimated at about $125 per hp installed when driven with high efficient synchronous motors. This type of electric station required separate foundations for the reciprocating compressor and slow speed motors for direct connection. From Fig. 2, however, it can be noted that the reciprocating compressor will require less electric power than the centrifugal type of compressor.

Today, however, when considering rotating machinery, the electric motor driven centrifugal station costs should not exceed $70 per hp, with service delivered at the station site by the electric utility on an anticipated revenue basis. Further, after-cooling of the compressed gas is not deemed necessary at the relatively low compression ratios employed of 1.3 to 1.4.

This cost closely checks with construction contracts as published in the *Engineering News Record* for October, 1947, showing an index of 300 in 1944, and an index of 420 in 1947, or 40 per cent increase today (1947) over the wartime costs of 1943-1944.

An examination of construction costs of the Big Inch pump stations as revealed by War Assets Administration report of January 4, 1946, entitled "Government-Owned Pipelines", shows that the cost per station for each of the twenty-six 4500 hp stations of the 24-in. line was $272,000 or $60.50 per hp. This average cost included some 170 miles of power lines for the first 11 stations and the substations at the 26 stations, which ordinarily would be provided today by the power suppliers. If these electric facility costs of highlines and substations were eliminated, the actual station costs would have been about $50 per hp in 1943, but today, as of 1947, the costs would be increased about 40 per cent, or to $70 per hp. As the centrifugal gas blower resembles in mechanical detail the centrifugal pump, and with all other factors and equipment such as motors, switch gear, piping, valves, and size of building being of the same general character, it would appear that the electric centrifugal station could be constructed for about the same cost as the oil centrifugal station, namely, $70 per hp in comparable hp capacities.

● **Relation between capacity factor and power required.** The usual procedure followed in making economic studies of pumping costs is to assume that the given pipe line will operate at 100 per cent capacity year after year and, therefore, the power required will be at 100 per cent capacity rating.

This high capacity prediction of operation is pleasing to the bankers supplying the investment funds because it results in maximum revenue figures and consequent profits or dividends. However, when an attempt is made to study operating costs provided the capacity is reduced, the power costs are generally reduced in direct proportion to the assumed reduction in capacity. In making the study of electric motor operating costs, however, it is found that fixed costs usually amount to only 15 to 20 per cent, and the power required amounts to 80 to 85 per cent of the total cost.

This approach was encountered so many times in making competitive cost studies to determine whether electric motors could be used in the oil and gasoline transportation industries, that information was sought to determine the exact amount of electric energy required to perform pumping operations in a totally electrified pipe line. It was obtained from the owners of 130 miles of 10-in. pipe line using four 800-hp pump stations, 40,000 bbl per day design capacity, and covered seven years' operation. Table 1 is offered to indicate the true relation between capacity factor and actual electric power usage in per cent of possible maximum usage for the period 1929 to 1935, when liquids are being handled.

TABLE 1. 130 miles 10-in. line, four 800-hp electric centrifugal stations, 40,000 bbl per day capacity. Barrels pumped, kilowatthours consumed, for 7 years—1929 to 1935.

	Oil pumped			Electric power consumed	
Year	Annual bbl	Average bbl/day	Capacity factor, per cent	Annual kwhr	Electric usage, per cent of max.
1929	14,510,731	39,900	100.0	20,862,500	100.0
1930	12,850,474	35,200	88.5	16,177,000	77.5
1931	12,275,035	33,600	84.5	14,296,736	68.7
1932	10,509,829	29,000	72.8	10,348,700	49.7
1933	11,245,861	30,800	77.3	11,790,300	56.5
1934	8,688,550	23,800	59.8	6,206,600	29.8
1935	11,358,624	31,100	78.1	12,081,600	58.0
Total	81,439,104			91,763,436	
Average			80.0		62.6

From Table 1 it can be noted that the power usage expressed in per cent of possible maximum usage (600 kw per station) varies approximately as the square of the capacity factor when expressed as per cent of maximum design capacity. This relation seems to hold true for each year, and for the average of the seven years studied. Reviewing the Big Inch operations (24-in. line) for 1944 and seven months of 1945, shown in Table 2, the same results were obtained as shown for the seven years' operation of the 10-in. line.

TABLE 2. 1250 miles 24-in. line, 26 4500-hp electric centrifugal stations, 330,000 bbl per day capacity. Barrels, pumped, kilowatthours consumed for 1-7/12 years—1944-1945.

Year	Barrels pumped	Capacity factor, per cent	Electric usage, per cent of max.
1944	114,258,000	94.7	88.9
1945*	67,089,000	95.6	90.6

*Seven months.

Realizing that gas transmission lines must also operate somewhat after the pattern of the oil lines studied, it was deemed advisable to obtain similar throughput data, if possible, from several operators of such gas pipe lines.

TABLE 3. 24-in. OD line, ⅜-in. pipe thickness, 50-mile spacing, capacity 312,000,000 cu ft per day, compression ratio 1.33, initial pressure 765 psia, average compressibility factor 0.905 "N" 1.250, K-4340, sp gr 0.60, suction 60 F, discharge 117 F.

Horsepower and kilowatt requirements of a station equipped with three 2000-hp induction motors, each driving a centrifugal compressor unit, the three in series.

Per cent capacity factor	Million cu ft per day	Suction pressure, psia	Compression ratio	Electric centrifugal		
				Units operated	Total bhp	Input kw
100	312	575	1.33	3	5,300	4,230
83	260	639	1.20	2	2,800	2,240
90	281			2 or 3	3,700	2,950

The ordinary gas transmission line serving a variety of customers, domestic and industrial, generally is not in position to maintain as high capacity factors as the oil transporter does, because of the wide fluctuations in the demand by the domestic customer; however, to overcome this wide fluctuation in capacity requirements, the gas transporter can maintain fairly high capacity factors by use of underground storage or liquefaction plants situated near the terminus to absorb excess deliveries over the demand during the warmer months. Such capacity information is shown in Fig. 1 and is supplied for two transmission lines (20 in. and 16 in.), having underground storage facilities, and for a 12-in. line serving a typical city in the Southwest without storage facilities. Note that the lines with storage space operate at much higher capacities than lines without storage. It can be noted also that the lines using storage space find it impossible to operate at 100 per cent capacity for a given year. The power requirements, shown on the "Typical Capacity" curve for the lines with storage, are the author's theoretical percentages based on the following study, for no definite information is available concerning the power usage, as was the case of the oil lines studied and shown in Tables 1 and 2 for electric drive, the 10-in. crude line and the Big Inch, respectively.

As gas is compressible, it was felt that the same relationship between capacity factor and power usage as found in the case of lines pumping liquids and discussed previously would not exactly apply to gas pumping.

To illustrate the change in power requirements in a typical centrifugal gas compression station, when required deliveries are less than under maximum design conditions, Table 3 is offered with line and installed station equipment that should simulate closely the conditions of a newly designed pipe line and yet appear to fit closely the situation for one of the Big Inch lines (24 in.), but omitting the effect of the 20-in. parallel line.

From Table 3 it can be noted that the brake horsepower at reduced capacities decreases very greatly from that required at 100 per cent design capacity; as an example, with two compressors in operation and 83 per cent line capacity, the kw required is only 53 per cent of the maximum. The power required for intermediate values of capacity factor can be determined from the curves as shown in Fig. 2. Thus, at 90 per cent capacity, about 70 per cent of the maximum power is required, since two units equipped with pressure control vanes could be operated for this condition. Thus, in gas pumping, the power usage expressed in per cent of maximum varies as the capacity factor expressed in per cent raised to the 3.5 power.

● **Flexibility of operation.** It is true the induction motor operates at a fixed speed; however, the history of the oil transportation business, with its almost universal acceptance of the induction motor to operate centrifugal pumps, seems to refute the idea that speed flexibility is very desirable. They seem to get along satisfactorily with only two units installed, and their choice, if all stations are operated, is to deliver 100 per cent or 70 per cent to capacity, and other lower capacities can be achieved by shutting down a unit or units at intermediate stations. With three units in each station, as was the case of the Big Inch lines handling liquids, the choice of efficient capacity throughput was increased, in that with two units in operation 83 per cent capacity could be achieved, and with one unit 55 per cent capacity was possible. When maintaining uniform high discharge pressures in gas pumping, the same efficient use can be made of the electric equipment for reduced capacities.

The fact that at the present time two stations—No. 5 and No. 15—at Little Rock, Arkansas, and Oldenburg, Indiana, respectively, on the Big Inch lines are being equipped with centrifugal compressors, six 1250-hp units in each station, to be operated with existing motors, and that about 80 more centrifugal units are on order, leads to the question of "What will be the operating costs of these electrified stations?"

For this purpose Table 4 is prepared, under the assumption of using one 24-in. line, maximum daily capacity of 312,000,000 cu ft, with initial pressures of 750 psig, and the number of compressor units as shown in Table 3, but using

FIG. 1.

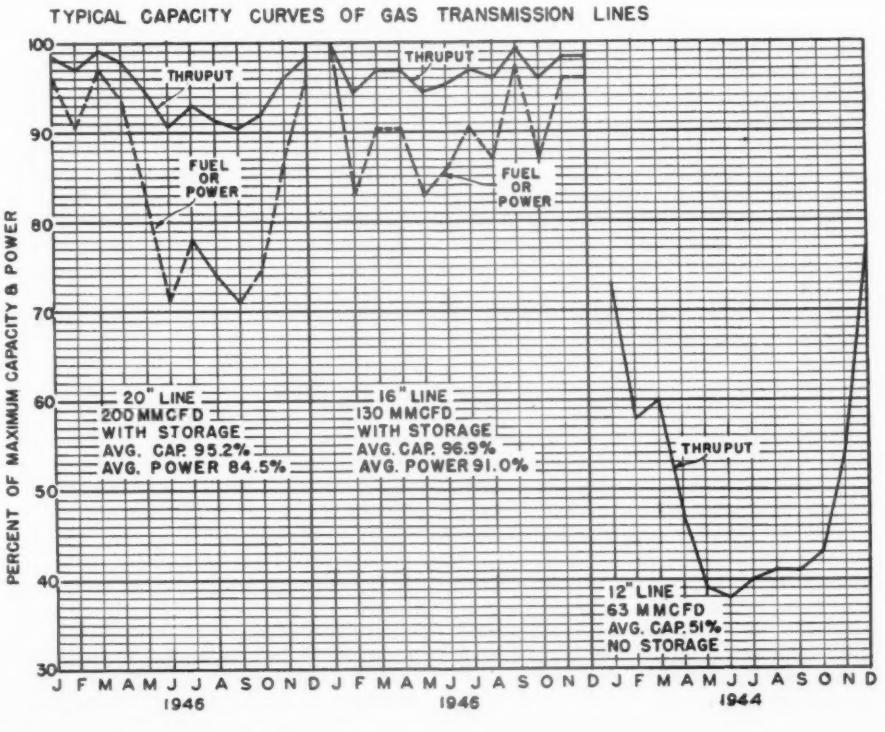


TABLE 4. Assumed annual operating cost at 95.2 per cent average capacity for electric centrifugal compressors (20-in. line Fig. 1).

Station investment—Electric motor—centrifugal compressor. Three 2000 hp at $70/hp....	$420,000
	Electric centrifugal
Interest 6.5 per cent, depreciation 3.5 per cent, taxes and insurance 1.25 per cent, (total fixed charges 11.25 per cent).....	$ 47,300
Labor, maintenance, etc.: $5/hp/year.....	30,000
Electric power: 3580 kw—31,400,000 kwhr at 0.7 cents per kwhr.....	220,000
Total (84.5 per cent power usage).....	$297,300
Average cost per day, (297,000,000 cu ft per day) 50 miles.....	$ 815
Cost per 1000 cu ft per 100 miles, includes line investment at $50,000 per mile, depreciation 2.5 per cent.....	1.02c

capacity factors of the 20-in. line with storage, on an annual basis from Fig. 1, and power requirements determined from Fig. 2.

In Table 4, the interest is charged at the allowable rate of return prescribed by the Government Regulatory Authorities, and the depreciation rates are the same prescribed by the Government Taxing Authorities. The electric power costs are those negotiated for comparable loads for the Big Inch stations after adjusting for decreased load factors and increased present day fuel costs.

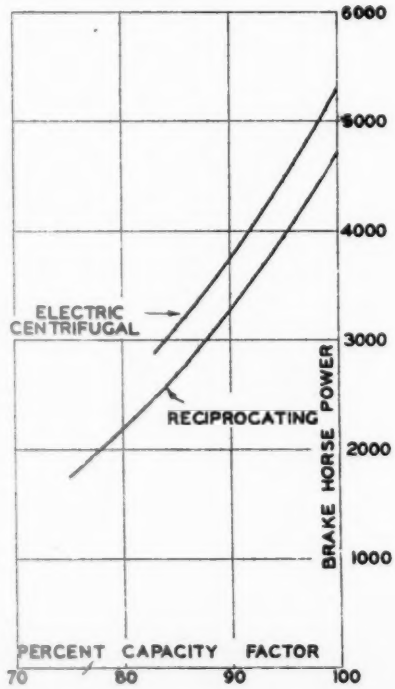
For a long pipe line with a large number of stations operating, the fuel gas saving of the electric stations is of considerable import and deserves great consideration in making studies of final delivery costs.

In the past some consideration has been given to applying the axial flow compressor instead of the conventional centrifugal compressor for gas pumping. Most authorities are agreed that the axial flow compressor would inherently have perhaps a 10 per cent better adiabatic efficiency than the centrifugal compressor, but its first cost, maintenance, and operating flexibility would tend to favor the simple multi-unit, single-stage centrifugal compressor.

Again consideration has been given, or rather some published articles seem to favor, the gas turbine as a prime mover for gas transmission stations. It would appear that the first cost of the gas turbine, properly equipped with intercoolers, reheaters, heat exchangers, and twin shaft arrangement, might approach the cost of the conventional reciprocating station, if high thermal efficiencies are to be obtained.

FIG. 2

STATION SPACING—50 MILES
CAPACITY—312,000,000 CU FT A DAY
24 IN. OD PIPE, ⅜ IN. WALL
DISCHARGE—765 PSIA
COMPRESSION RATIO—1.33
SUPERCOMPRESSIBILITY—0.905
"N" 1.250—K 4340



Then there would be the matter of maintenance of all this auxiliary equipment, accentuated by the higher temperatures of the inlet gases to the turbine. Today, ordinary thermal efficiencies of the gas turbine are limited to values of 20 to 25 per cent with temperatures of 1200 F, depending on the amount of auxiliary equipment utilized; whereas, the conventional gas engine when operated at somewhere near its rated capacity will show thermal efficiencies of 30 to 33 per cent. This difference in thermal efficiencies would mean that the gas turbine would consume perhaps 50 per cent more fuel than the gas engine.

It is possible that at such time in the future when metals that will withstand temperatures of 1500 to 1600 F are developed for continuous duty in the gas turbine, that then the gas turbine will deserve more consideration.

Some effort has been made to justify the gas turbine for gas transmission duty based on automatic control, perhaps feeling that station operating labor savings would be appreciable in that case. History is the best teacher, and one has only to review the attitude of the oil transporter in this respect. Many attempts were made to apply automatic control to electric driven main line pump stations, with the result that the fixed charges and maintenance on the required automatic equipment was greater than the cost of the operating labor that they attempted to save.

It is true that automatic control of field gathering stations and oil wells has been in successful use for many years, but for main trunk lines, the oil industry apparently will not accept the hazards entailed, and the gas transmission industry also might fall into this same category, especially if gas turbine drive is to be considered.

● **Use of electric centrifugal stations for temporary "booster" service.** At the present time an installation is being made in Kentucky of three 2000-hp motors driving centrifugal compressors located at a midway point between existing gas engine driven reciprocating stations that were spaced 80 miles apart. The 24-in. line capacity without the intermediate booster station was 290,000,000 cu ft per day when discharge was 715 psia and suction 397 psia R 1.8. A gain of about 15 per cent in capacity is expected to be achieved by means of this installation. The choice was to install about 23 miles of parallel 24-in. pipe as a "loop," the cost being slightly more than $1,000,000, or install the booster station. The pipe could not be obtained in time for the anticipated increase in gas demand, so the simpler method was to install the booster.

In general, for an increase in capacity of 25 per cent, a "loop" of half the distance between stations becomes necessary, and for a 50 per cent increase a "loop" of three-fourths the distance becomes necessary.

Gasoline used by motorists is made from both crude oil and natural gas. About 89 per cent of the average gallon of gasoline is made from crude oil and 11 per cent is made from natural gas.—*The Petroleum Data Book*, Dallas, Texas.

☆ ☆ ☆

The "loop" operating expense becomes the fixed charges, whereas, with the intermediate booster electric-centrifugal station, the principal operating expense becomes the sum of fixed charges plus the cost of power. In general, for most all conditions of desired increase in capacity, the booster station cost is approximately one-third to one-half the first cost of the parallel loops, and if the booster station is to be operated only two or three months of a given year, during the winter season, the operating costs of the two methods; namely, "loops" or booster station, will be about equal. If the capacity increase is desired continuously, however, the loops will prove more economic over a period of years. Another use for the booster station would be in the case of a newly discovered gas field adjacent to the pipe line, where the life of this field might be short, yet a ready sale for the gas production up the line might be available. The salvage value of the electric booster station, in terms of per cent of its original cost, is always great, thereby making its use elsewhere under similar conditions a distinct economic possibility.

● **Conclusions.** The use of electric motor driven centrifugal compressors for main line transmission is entirely feasible from an economic viewpoint when capacity factors and power usage are given proper consideration.

Present electric utility rate schedules are sufficiently low to justify the electric-centrifugal station, if consideration is given to the ability to deliver the same amount of gas at the destination as originally taken into the line.

It is not deemed necessary to "after cool" the discharged gas from an electric-centrifugal station, for compression ratios employed should ordinarily not exceed 1.4, resulting in final temperatures of only 140 F, with 80 F suction temperature in summer months.

Sufficient flexibility in operation can be obtained with the multi-unit single-stage centrifugal compressor driven with a constant speed induction motor, comparable to the flexibility now obtained by the oil pipe line station using centrifugal pumps.

At the present time the gas turbine for direct drive to centrifugal compressors, when considering its relative poor thermal efficiency and limitations for continuous duty, will not seriously compete with the electric-centrifugal compressor for gas transmission.

The use of the electric-centrifugal intermediate booster station in an existing line for temprorary or wintertime operation is justified from an economic viewpoint in lieu of laying parallel "loops." ★ ★ ★

$4 Billion marked for 1948 expansion

By ERNESTINE ADAMS, *Associate Editor*

Editor's Note: *This is not intended as a statistical analysis. It is rather a discussion of trends revealed by the 1947 annual reports of oil and natural gas companies. These reports are no longer confined to financial statements but are remarkably clear pictures of the state of the industry that provide a background on which to impose the future.*

* * *

THE petroleum and natural gas industry of the United States spent about $3 billion here and abroad on capital investments last year, judging by the 1947 annual reports, most of which were released in April.

EXCLUSIVE

If there had been no shortages the figures might have reached $4 billion in 1947, almost as much as the first year's cost of the Marshall Plan. It should easily do so in 1948 in the event needed materials are available.

The estimate on capital expenditures is drawn from the investments listed in Table 1. The inference that shortages halted almost a fourth of the development and construction work is based on comparison of 1947 programs and 1947 accomplishments. A few companies gave actual figures and these showed around one-third of the 1947 program had been held back by lack of materials. The average was obviously less than a third but few, if any, companies were not harassed by inability to get steel goods.

● **Profits.** The industry made at first blush what appeared to be enormous profit also, but twice as much was really needed for replacement, modernization, and expansion of properties outside of profits. Some of the money for capital expenditures came from selling more stock but the bulk of it was borrowed.

Good profits alleviated what would otherwise have been an impossible situation. The oil companies had the cash and credit to hold their own in the steel market and to work wonders in expanding their facilities. Otherwise the nation would have suffered real and widespread lack of gas and oil products and the answer would have been a rationing of shortages.

Responsibility of oil management is well demonstrated by its traditional willingness to invest more than it makes. It has been doing so since Colonel Drake brought in that well.

It paid reasonable dividends to stockholders in 1947; enough to keep investors interested in a time of inflated money. The remainder is marked for leases, wells, pipe lines, plants, etc.

● **Demand.** Behind the record capital expenditures and record profits were the largest demand and the largest supply in the history of the industry. For the first time (except for periods when the country was at war) demand edged out supply. Shortages were spotty and many of these were caused by insufficient distribution facilities. It was not the actual shortages that counted so much — they were small—but the fact that the balance between supply and demand was so even that the industry was continuously pushed to utmost effort.

The annual reports explain the high demand in various ways.

Shell Union Oil Corporation elaborates on the expanded uses of petroleum with an interesting set of figures showing growth of oil burning units (Table 2).

The Atlantic Refining Company depicted the growth in the demand of individual consumption by chart as shown in Fig. 1. The company report points out:

"It is about what might have been expected if growth or demand had proceeded normally through the war years and to date. Domestic demand for petroleum last year was about 75 per cent above prewar; industrial activity generally was about 85 per cent above prewar. The current high demand cannot be considered a temporary phenomenon."

"Unusually severe 1947-1948 winter weather conditions not only increased a demand already high," reports Lion Oil Company, "but also disrupted distribution and seriously interfered with oil production."

The situation drew still another analysis by Texas Gulf Producing Company. Its report states bluntly: "The cause of the extreme fuel shortage this winter is that coal has fallen down on the job of furnishing its historic share of fuel energy. Since 1920 the production of coal in the United States has declined 10 per cent whereas the production of oil has multiplied by almost 5 times and the production of natural gas by more than 5 times. The oil and gas industry has gone ahead and expanded on the traditional American pattern of more production, higher quality and lower cost, whereas coal production has declined for a variety of causes peculiar to that industry."

TABLE 1. Capital investments and income.

Company	Capital expenditures (000 omitted)	Net income (000 omitted)
Atlantic Refining Company	$ 38,890	$ 15,897
Bishop Oil Company	624	347
Barnsdall Oil Company	9,957	9,119
Cities Service Company	96,000	40,464
Continental Oil Company	45,600	31,356
Gulf Oil Corporation	180,956	95,540
Lion Oil Company	8,800	7,991
Mid-Continent Petroleum	22,311	17,638
Ohio Oil Company	26,791	29,161
Phillips Petroleum	87,883	40,893
Plymouth Oil Company	4,365	4,197
Pure Oil Company	39,000	21,197
Quaker State Oil Refining	1,532	2,762
Richfield Oil Corporation	20,025	11,853
Shell Union Oil	138,431	59,874
Sinclair Oil Corporation	89,187	48,776
Skelly Oil Company	24,328	21,090
Socony-Vacuum Oil Company	141,400	97,708
Standard Oil of California	148,000	107,268
Standard Oil (Indiana)	220,000	94,880
Standard Oil (New Jersey)	426,000	268,626
Standard Oil (Ohio)	29,130	16,390
Sun Oil Company	37,459	24,339
Sunray Oil Corporation	14,000	10,008
The Texas Company	137,000	106,312
Texas Gulf Producing	1,318	2,353
Tide Water Associated	34,481	30,176
Union Oil of California	42,352	18,910
Wilcox Oil Company	548	582
	$2,066,368	$1,235,707

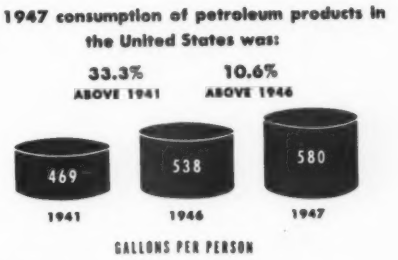


FIG. 1. *Atlantic Refining Company illustrated growth of consumption in its annual report by this chart.*

The company could have added that at some time in that period the coal industry lost its initiative while management of the oil industry has kept its dynamic qualities despite a running interference that continues actively down to the present.

Secretary of Interior Krug stated that for the first time in U. S. history, oil and natural gas supplied more of the nation's energy than coal in 1947.

Seaboard Oil Company mentioned one factor that had close relation to supply and distribution but has been forgotten by those outside the industry. States the report: "The inevitable effect of the war on the industry was to interfere with its normal expansion program and this, coupled with deficiencies in materials and transportation facilities, resulted in the shortages of petroleum products which were experienced in some parts of the country during the past winter."

No one can doubt that there would have been ample supply of petroleum products and gas and satisfactory distribution if the industry had been able to obtain all the material it needed for its 1947 expansion program.

● **Price.** There has been a lot of doubtful economic philosophy poured out in the past year about whether oil prices should go up or not and the annual reports if confined to profits provide the status quo-ers with ammunition. They should be careful, however, that it doesn't explode in handling.

First item to examine is the dollar value as applied to needed expansion.

Continental Oil Company states in its 1947 report: "A study recently prepared by leading petroleum economists indicates that capital expenditures of 30 major oil companies in the United States for the year 1947 aggregated $1.95 billion, of which approximately $1.11 billion, or 57 per cent, was due to the rise in construction costs from the 1939 level and to some technological changes, such as the necessity for deeper drilling."

Creole Petroleum Corporation estimates it could have built the Amuay (Venezuela) refinery project in 1940 for half the $120,000,000 now required.

The increased cost of replacing depleted reservoirs and worn out or obsolete facilities was a double jeopardy because depletion and depreciation are based on original costs. In this instance original costs were far below present costs. Standard Oil Company (New Jersey) explained:

"Normally, such allowances (depreciation) amount to about two-thirds of the money required by the Company and affiliates for plant replacement and expansion. In 1947, however, because of high construction costs and the pressing need for new facilities, the depreciation allowances amounted to only one-third of the money necessary."

Cities Service Company put it this way: "Sound economy would require that those who use up or wear out a facility should pay for it, but under present accounting practices prescribed by the accounting profession, and Federal tax regulations, plant facilities are being amortized on an original cost and not a replacement cost basis.

"These conditions require that current earnings be large enough to provide the capital needed to replace plant and equipment if companies are to continue successful."

Standard of Ohio (and others) depicted the wide difference between provisions for depreciation and depletion and capital expenditures by graph (Fig. 2) and Standard California by Table 3.

One point that was not stressed by the reports in proportion to its importance is the fact that research is accelerating obsolescence of plants and equipment in every branch of industry. Possibly because it could not be tangibly measured this very important factor in increased costs was seldom mentioned although the reports on results of research revealed countless advances in methods requiring new equipment.

TABLE 2. Shell Union Oil Corporation shows growth of petroleum units 1941-1946 and estimated 1947 in its annual report.

Consumption units in use	1941	1946	1947	Per cent increase 1947 over 1946	Per cent increase since 1941	
					1946	1947
Passenger cars (thousands)	26,713	26,901	28,830	7.2	0.7	7.9
Trucks and buses (thousands)	4,682	5,680	6,000	5.6	21.3	28.2
Tractors (thousands)	1,783	2,672	2,844	6.4	49.9	59.5
Space heaters (thousands)	2,000	3,035	4,250	40.0	51.8	112.5
Oil burners (thousands)	2,269	2,673	3,200	19.7	17.8	41.0
Diesel locomotives (units)	1,032	4,196	5,400	28.7	306.6	423.3

Increased cost of drilling wells was more obvious. The industry was forced to take greater chances, and had to drill deeper on the average. With higher prices for crude it could afford the costly over-water drilling to explore the tidelands. Humble Oil and Refining Company showed its higher drilling costs by chart. (Fig. 3).

The report of Shell Union Oil Corporation gives some idea of the advance in costs of refining facilities:

"Illustrative of the increased investment cost is that while in 1937 it took about $9 of investment in refinery equipment to produce a gallon of refined product per day, it now requires about $35 of investment to do the same job due to the more extensive equipment required for manufacture of high quality products and increase in overall costs."

● **Price influence.** Seaboard's report contained the following statement on the influence of price:

"Historically, price has always been

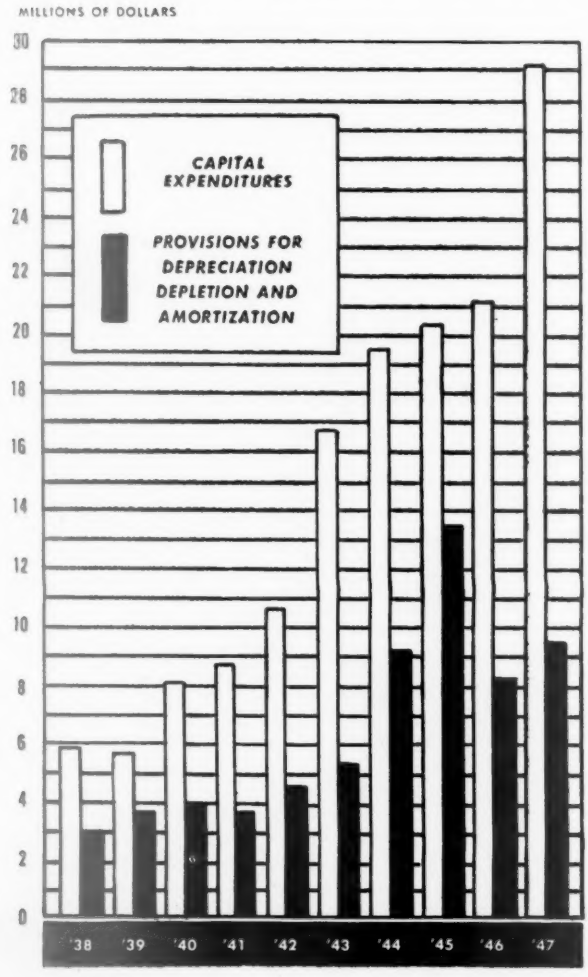
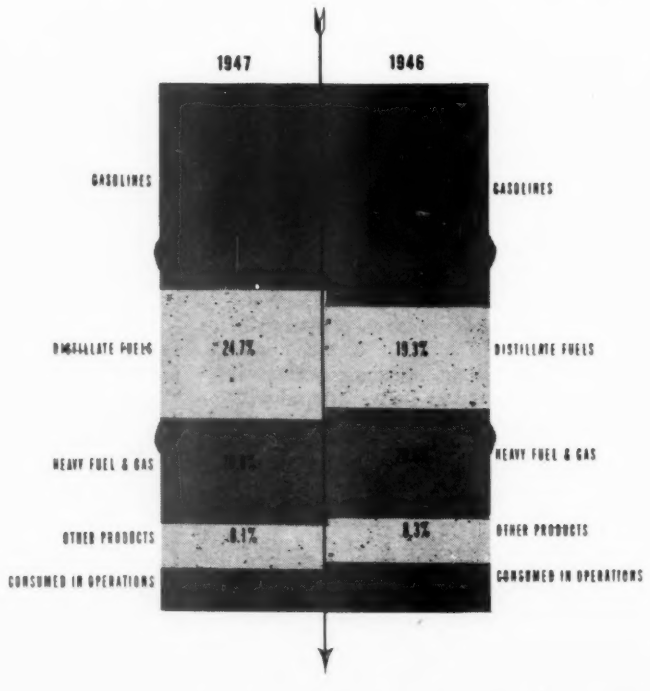


FIG. 2. *Standard of Ohio reveals wide discrepancy between annual capital expenditures and provisions made for depreciation, depletion, and amortization.*

FIG. 4. *Imperial Oil Limited depicted the change in average yield per barrel of raw material. Greater demand for distillate fuels (furnace, diesel, etc.) brought a larger proportion of this type of product.*



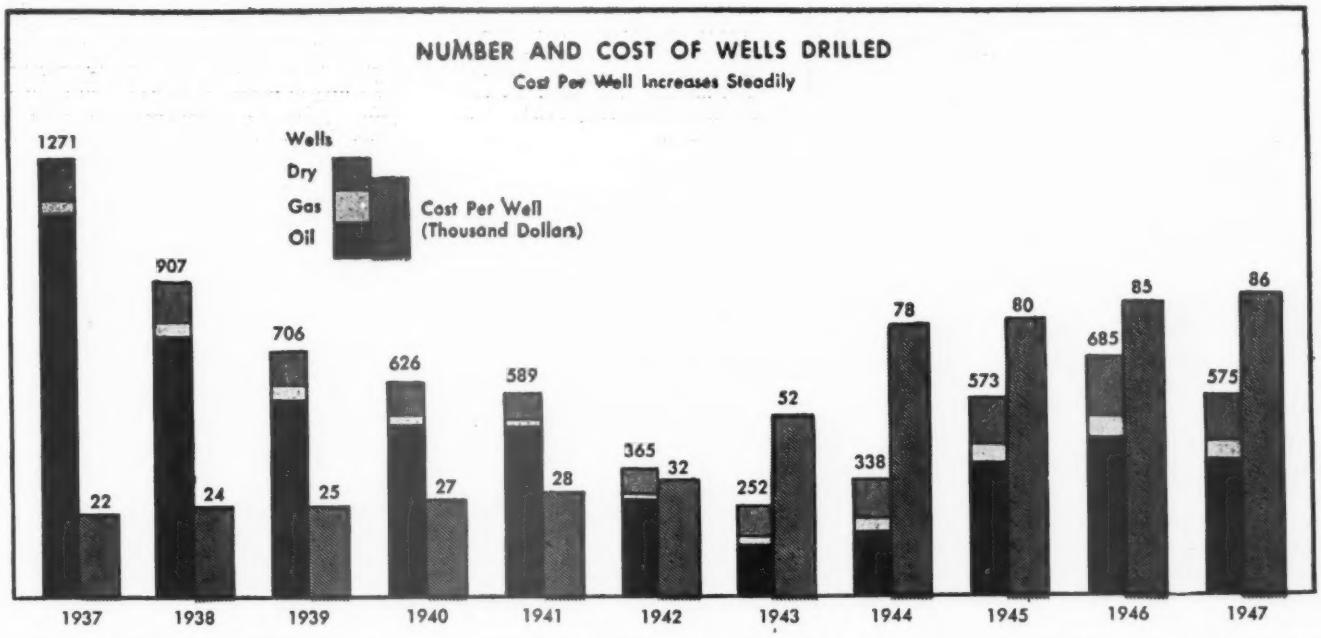


FIG. 3. *Humble Oil and Refining shows rise in its drilling costs.*

the greatest factor in our highly competitive system of free enterprise, and, barring further governmental regulation, will again serve to increase supply and, through the competition of other sources of energy, to reduce demand, thus serving to restore a more economic balance within the oil industry."

U. S. News recently carried these figures on the cost of living dollar changes since 1939, based on Bureau of Labor statistics:

Food dollar cut to	47c
Clothing dollar cut to	51c
Fuels dollar cut to (except gas)	60c
Gas and electricity raised to	$1.06

Employer's labor dollar cut to 50c.

From this it is evident oil is cheaper than prevailing living costs and gas is far too cheap to permit free competition with other heat and energy producers.

The effect of low oil prices on demand is explained by Standard of Indiana thus: "Oil prices were unduly low throughout the whole period 1927-1941, mainly because potential supply was somewhat in excess of demand. These low prices were perpetuated by OPA during and after the war. This had the double effect of discouraging oil discovery and the expansion of facilities and of stimulating many homeowners to switch to oil from other fuels. Low heating-oil prices thus helped to create our present supply problems. Even after several increases in 1947, petroleum product prices at the end of the year were only 112 per cent of the 1926 base, as compared with an average of 163 for all commodities."

The price element is not often discussed with reference to the refining branch but here it is also significant. Not only is it a constant pressure on conservation of the raw material used but it can do much to control specific supply. Imperial Oil Limited illustrates this in its graph of average yields from 1946 and 1947. (Fig. 4). In 1947 demand for heating and diesel fuels rose and processing was revised to give greater yields in this class of products. The refiner provides not only supply but the kinds of supply and an important factor in obtaining wanted products is to have flexible prices responsive to particular demands.

Sun Oil Company points out that profit at present prices is not out of line:

"When considered in their proper economic light as a percentage of the sales dollar, Sun's net earnings in 1947 were neither excessive nor out of line with normal, peacetime profits. Thus the Company's profit in the six years prior to the United States entry into the war averaged annually 6.08 cents of each sales dollar. Last year's profit of 6.82 cents per sales dollar closely approximates that figure.

● **Unitized operation.** What appears to be the most significant trend in the industry in view of the tight supply is the full promotion of repressuring fields, which is evident in annual reports of virtually all producing companies. Facilities for water (Fig. 5) and gas repressuring of hydrocarbon reservoirs are being installed as rapidly as materials can be acquired. This wholesale activity toward more efficient production insures greater supply as certainly as discovery of new fields. Recovery from present reserves is automatically increased by this method of extraction.

In the plans of individual companies, which we briefly review, the movement toward cooperative or unitized operation of fields is emphasized throughout.

It is augmented by secondary recovery programs that are clearly the result of higher crude oil prices. States the Ohio Oil Company report:

"The Company's extensive holdings in Eastern Illinois, originally developed in the early 1900's, were, before the recent crude oil price increases, nearing economic exhaustion. Secondary recovery, which is now justified, increases the recoverable oil reserves, augments the value of these properties and extends their productive life."

The following summary of present operations and future plans of individual oil companies is not by any means inclusive. It is only a glance at present and future operations touched upon in the reports to stockholders. For the most part no mention has been made of the remarkable accomplishments of 1947.

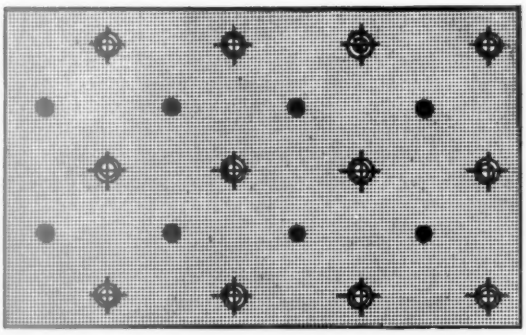
● **Amerada Petroleum Corporation,** 120 Broadway, New York, scheduled test wells on several new leases for 1948. Geological and geophysical exploratory work was expanded substantially during 1947 and the program is further enlarged for 1948. Development operations plans are also increased for 1948.

The company went into Canada for the first time in 1947 and exploratory work will proceed on its new holdings. It also has large areas in Venezuela with fair prospects.

● **American Republics Corporation,** Houston, Texas, has joined other operators in constructing at Silsbee, Texas, field, a natural gasoline and cycling plant with a 58 million cu ft capacity.

TABLE 3. Standard Oil Company of California's annual report shows difference between capital expenditures and tax provision for replacements.

	Prewar average 1936-1940	Wartime average 1941-1945	Postwar 1946	Postwar 1947
Capital expenditures	$23,900,839	$43,177,357	$88,512,082	$133,275,229
Provision for depreciation, depletion and amortization	19,619,482	33,028,606	39,628,520	44,910,856
Difference—financed principally from earnings	$ 4,281,357	$10,148,751	$48,883,562	$ 88,364,373



This cut shows a portion of a typical "five-spot" operation in Pennsylvania and New York fields. The oil well is surrounded by four water intake wells. Water is forced into the oil-bearing sands to increase the flow of oil toward the oil well where it is pumped to the surface. Secondary recovery has greatly prolonged the life of these old fields.

= WATER PRESSURE INTAKE

= OIL WELL

FIG. 5. *Quaker State Oil Refining Corp. explains water repressuring to stockholders.*

Drilling operations were going forward rapidly and the company expects to do more deep drilling in 1948.

● **Argo Oil Corporation,** Denver, Colorado, a producing company, intends to continue intensive efforts to increase its sources of oil supply by extending proved areas and by acquiring and exploring new territories. Its success in 1947 is attested by the fact that net profits were 10 times those of 1946.

● **Atlantic Refining Company,** Philadelphia, Pennsylvania, spent $38,890,000 for additions to plant and equipment, which the company figured raised the net value of capital assets by $18,000,000 when high costs and the usual allowance for depreciation, etc., were considered. Atlantic does not include expenses for oil search in its capital expenditures. These were five times as large as they were before 1940.

Remodeling of existing apparatus is in progress at Port Arthur, Texas, to increase refining capacity by one-third. Changes at Point Breeze, near Philadelphia, is expected to add 12 per cent to the plant's capacity in 1948.

Contracts have been let for four new barges of 9000 bbl capacity each to be used in the Philadelphia harbor. Tankage is to be increased by 150,000 bbl capacity at product pipe line terminals.

Exploration will continue this year in Venezuela, Nicaragua, and Cuba. Haitian concessions were turned back.

Atlantic has joined in two cooperative plans with maximum production as their objectives and participation in other like conservation projects are possible.

An enlarged research laboratory in Dallas marks greater expansion in this department.

● **Barnsdall Oil Company,** Tulsa, Oklahoma, will carry on increased exploration and production operations in 1948. Last year $9,953,000 was paid out for leases, drilling, etc., and the sum will probably go higher in 1948.

A gasoline absorption plant capable of processing 40 million cu ft of gas a day is being erected at Newhall, California. An effort will be made to complete the additional facilities in the gas transmission lines that were planned in 1947. Another gasoline absorption plant will be constructed at Lake Charles, Louisiana, as soon as materials are available. It will manufacture 27,000 gal of oil products a day. West Tepetate field, Louisiana, will have a third gasoline absorption plant by the midde of 1948 with a productive capacity of 30,000 gal a day.

A cycling gas and gasoline plant with a capacity of 50 million cu ft of gas per day to make 4000 bbl of products was put into operation early in 1948 in the Benton field, Louisiana.

Barnsdall's program shows a strong emphasis on repressuring operations and on cooperative unitization of fields for greater ultimate production.

● **Bishop Oil Company,** a drilling and producing organization operating in California, Texas, Oklahoma, and Kansas, spent $624,000 in 1947 acquiring new properties, drilling, and equipping wells for production. Activity in 1948 is expected to be greater. Executive office is at 315 Montgomery Street, San Francisco, California.

● **British-American Oil Company, Ltd.,** Toronto, Ontario, Canada, has an oil-finding and development program for 1948 that outstrips any previous expenditure. Western Canada exploration efforts alone will exceed one million dollars.

The new blending and packaging plant at Clarkson was put into operation early in 1948. Expansion of the Montreal refinery including installation of a fluid catalytic cracking unit is expected to be completed next year.

● **Cities Service Company,** 60 Wall Street, New York, spent $96,000,000 in 1947 for new construction and acquisitions, which was divided as follows: $58,000,000 for petroleum subsidiaries; $21,000,000 for natural gas, and $17,000,000 for electric utilities.

Expansion of the East Chicago refinery is in process. Cities Service and Continental Oil are constructing at Lake Charles, Louisiana, what is said to be the largest plant in the United States for manufacture of solvent refined lubricating oils. Construction is under way on a 26-in natural gas pipe line from Hugoton field to Kansas City.

Cities Service companies also have substantial interests in Central and South America where exploratory operations will continue.

Cities Service Research and Development Company, in cooperation with M. W. Kellogg Company, is continuing in 1948 its research on producing synthetic gasoline.

● **Continental Oil Company,** Ponca City, plans to enlarge its Ponca City, Oklahoma, refinery, purchased in 1947 from WAA, from a capacity of 33,000 bbl to 55,000 bbl. The company's West Texas crude output would be brought by pipe line to meet the increase in refinery runs. Work of enlarging the Denver, Colorado, refinery is expected to be completed in 1948, virtually doubling output.

Continental owns 35 per cent in the Lake Charles, Louisiana, lube plant.

Contracts have been let for construction of a refinery at Billings, Montana, which will have a crude capacity of 7500 bbl a day. The plant will probably not be completed until late 1948.

Continental has an extensive program of pressure maintenance and cycling operations. These are carried out alone or in cooperation with other producers.

● **Creole Petroleum Corporation,** Edificio Creole, Los Caobos, Caracas, Venezuela, South America, in 1948 plans to reduce preliminary exploration and concentrate on drilling in prospective areas.

Creole's big project is the Amuay refinery, which is designed for a rated capacity of 60,000 bbl a day.

The Ule-Amuay pipe line, begun in 1947, is running behind schedule because materials are slow in reaching Venezuela but the company hopes to complete the project by the end of 1948.

Development program calls for continuing study to insure efficient production, return of gas to reservoirs to maintain pressure, light ends recovery, and utilization of gas.

● **Derby Oil Company,** Wichita, Kansas, in its report states that the present program includes participation in the drilling of three exploratory tests, development of proved areas as fast as materials are available, and expansion of facilities at the Wichita refinery.

● **Gulf Oil Corporation,** Pittsburgh, Pennsylvania, made additions to its properties and plants amounting to $180,956,000 and was obliged to borrow $100,000,000. The company had a large exploratory and drilling program in 1947, which is being continued. Its half interest in Kuwait Oil Company jumped total production for the organization with the 13 wells in Kuwait producing 60,000 bbl a day at the end of the year.

The tanker fleet of the company is 50 per cent above prewar capacity, seven additional tankers having already been put into operation in 1948.

Three modern stills for crude oil distillation and a 32,000-bbl polyform refining unit are under construction at Port Arthur. Another polyform unit is being built at the Philadelphia refinery, which will have capacity of 16,000 bbl a day.

A new distillation unit and fluid catalytic cracking unit are being installed at the Toledo refinery along with other modernization scheduled for 1949 completion. Cincinnati will have a new catalytic cracking addition.

A new refinery is under construction at Puerto La Cruz in Eastern Venezuela.

Gulf is increasing its storage capacity in the United States by 159 million gal.

The building program of the research facilities at Harmarville, Pennsylvania, is still in work.

Gulf's research department, with a big

year in 1947, has all the impetus for more important progress. The Gulf airborne magnetometer is being used more in exploration and is being improved. The 1948 program calls for further research in products, especially gasoline; in production methods to increase recovery; in refining, especially on Fischer-Tropsch process for synthetic fuels and lubricants, and in chemical processes to use refinery by-products.

● **Houston Oil Company of Texas**, Petroleum Building, Houston, Texas, has eight oil discoveries and three extensions made last year to receive full development attention this year. Facilities for gas transmission are expected to be improved with prospects of increased demand in the Texas City area.

The report states that the situation "with respect to materials and equipment has not improved, but has, on the contrary, become more serious."

● **Humble Oil and Refining Company**, Houston, Texas, has a program calling for expenditures of $167,000,000 in 1948.

In 1948 all exploratory effort will be increased, report indicates. More seismograph crews will be added and more wells drilled including tests in the Gulf.

If sufficient steel is available, Humble plans to drill about 725 wells in 1948. The drilling and production facilities are expected to cost about $133,000,000 in 1948 compared to $67,500,000 last year.

New tanks and docks at Baytown, Texas, were begun in 1947 and are scheduled for completion soon.

Humble Pipe Line Company spent $14,170,000 in expansion and improvement in 1947, more than is planned for capital expenditures in 1948, which are estimated at $8,000,000.

Refining expansion will rise considerably this year with a $16,000,000 program planned. Investments in this branch reached $10,000,000 in 1947.

The major project planned in '48 is a new pipe still with a capacity of 45,000 bbl daily. A lubricating oil plant, begun last year, was completed this year.

Research is expected to require about the same amount in 1948 as it did last year, which was approximately $3,800,000. Two projects in work are the study of oil reservoirs in limestone formations, such as in West Texas, and the study of composition of petroleum as a basis for revising refining technology.

● **Imperial Oil Limited**, Sarnia, Ontario, Canada, totaled capital expenditures last year of almost $24,000,000, about $3,000,000 more than in 1946. Before these last two years, investments ran around $4,000,000 a year, usually less. Borrowing supplied a substantial part of the capital.

Development of the important Leduc field, Alberta, discovered by Imperial, is still the big project of the company. Development wells are being drilled all around the Leduc area and the Whitehorse refinery, purchased from the government, is being moved from the ill-famed Canol project to Edmonton to process Leduc crude. The entire plant is expected to be in operation by the last of this year.

The modernization program at the Montreal East refinery is expected to be completed by July and ready for full operation.

Departments of the company cooperate in such research projects as developments of suspensoid cracking process, laboratory and field tests on heating oils and the development of new lubricants, greases and waxes.

Two new lake tankers will be ready for operation in 1948 and the third and largest ship may be completed.

● **Lion Oil Company**, El Dorado, Arkansas, reports that the new ammonium nitrate prilling plant, begun in 1946 and completed in 1948, is the first of its kind in the country.

Like many others, Lion Oil had transportation difficulties in 1947 and intends to improve facilities in 1948.

Lion in 1948 purchased for $10,500,000 from the United States government the chemical plant near El Dorado, Arkansas. The new facilities are part of the long-term expansion program of the company.

● **Louisiana Land and Exploration Company**, New Orleans, Louisiana, has a program of seismic surveys in progress. The company is a leasing and producing concern that cooperates on most of its drilling activities with others.

● **Maracaibo Oil Exploration Corporation**, Continental Building, Dallas, Texas, owns leases and royalty interests in Louisiana, Texas, and Kansas, and in Venezuela. Its net income in 1947 more than doubled that of 1946.

The company with other joint owners have a repressuring program for the Paola district, Kansas.

● **Mid-Continent Petroleum Corporation**, Tulsa, Oklahoma, expended $22,311,000 in 1947 for replacements of and additions to capital assets. It is continuing active search for new reserves and work is progressing on its fluid catalytic cracking unit, which is scheduled to be completed before the end of the year.

● **The Ohio Oil Company**, Findlay, Ohio, increased its capital expenditures from $14,014,000 in 1946 to $26,791,000 in 1947. The company expects the rate of capital expenditures to continue this year.

Development of oil prospects will be pushed again in 1947 as it was last year. With price increases sums can be expended on a program of secondary recovery in eastern Illinois.

Modernization and enlargement of Ohio Oil's plant at Robinson, Illinois, is under way and is expected to be on full stream the latter part of this year. It has a rated 25,000 bbl a day capacity.

● **Pacific Western Oil Corporation**, Los Angeles, California, is concerned with finding and developing crude reserves. It raised its production some, not greatly, last year and acquired extensive holdings in the Rocky Mountain area.

● **Pan American Petroleum & Transport Company**, 122 East 42nd Street, New York, points out that during the last 10 years 83.5 per cent of the company's earnings have been reinvested or plowed back into the company.

In 1948 expansion is promised for the new Chemical Division, organized in 1947 with offices in New York and Texas City, and for the Research Department. A new automotive research laboratory is under construction at the Curtis Bay, Maryland, terminal, which will be one of the most modern units for testing automotive fuels and lubricants.

A gas transmission line from Chocolate Bayou field to Texas City is being built by the company, which also has a regulating terminal station in work.

In 1948 a Texas City cracking unit will have a second electrical desalter to reduce corrosion and increase capacity. Cutback asphalt equipment will be completed and ready for operation in 1948.

Pan American is another company that has adopted some reservoir repressuring plans as a method of increasing ultimate production. One repressuring and stabilization plant is being constructed at Olive field, Hardin County, Texas.

● **Panhandle Producing and Refining Company**, Wichita Falls, Texas, is reorganizing its geologic and exploration department in preparation for undertaking explorations on a broader scale. Recent operations have stressed development.

● **Phillips Petroleum Company**, Bartlesville, Oklahoma, expects to spend $120,000,000 on new capital investments in 1948. The company plans to drill 550 wells at a cost of $30,000,000 and spend $7,000,000 in acquiring properties.

Phillips is already operating in Canada, Colombia, and Venezuela, and has also acquired for $2,000,000 a 27 per cent interest in American Independent Oil Company, organized to enter foreign countries for exploration and development of oil resources.

The company holds major interests in two unitization projects in Oklahoma.

A refinery expansion program to begin this year will include installation of catalytic cracking facilities. A new lubricating oil plant is expected to be in operation at the Kansas City refinery by October and construction is already begun on a cracking unit.

Phillips natural gas production and processing has grown and continues expansion in 1948. Two large natural gasoline extraction plants are to be built and six existing plants are to be enlarged. The company is said to have larger resources of natural gas than any other firm. A Philblack carbon plant in Texas will be expanded to produce 185,000,000 lb in 1948. It made 154,000,000 lb in 1947.

The research division of the company plans a new testing laboratory for lubricants at the 66 Proving Stations at Bartlesville. States the report:

"An aggressive research and development program is being applied to problems ranging from devising methods for finding oil and gas to diversifying and upgrading the utilization of petroleum stocks."

● **Plymouth Oil Company**, Benedum Trees Building, Pittsburgh, Pennsylvania, expended $4,365,000 in 1947 for replacements and expansion, $900,000 of which was used to install a gas lift system in a San Patricio, Texas, field and

TABLE 4. A LIST OF 48 PETROLEUM COMPANIES AND

Company	Acreage lease and fee	Wells drilled, 1947	Producers, 1947	Dry, 1947	Total number producing wells owned	Daily average crude production, bbl	Daily average refinery crude runs, bbl	Pipe line runs, bbl	Common stock, no. shares	Gross operating income
Amerada Petroleum Corporation	1,724,000	272	216	56	2124	54,977			1,577,350	47,225,206
American Republics Corporation	1,684,956*	51	39	12	606	5,297			1,500,000	11,452,040
Argo Oil Corporation	183,852	17	15	2	324	5,774			617,820	5,006,952
Arkansas Fuel Oil Company									102,019	71,299,747
Atlantic Refining Company	11,258,400	100	67	33	2766	66,666	138,000	84,063,000	2,660,867	320,144,560
Barnsdall Oil Company	731,410	85	62	23	1930	28,252		7,223,000	2,223,307	24,433,212
Bishop Oil Company	19,426	28▼	24▼	4	287	2,754*			342,947	1,636,484
British-American Oil Company, Limited		96							2,772,642	
Cities Service Company			310			80,175	176,863	172,481,000	3,701,871	468,925,946
Continental Oil Company	2,009,441	551	377	174		104,955	77,880	40,241,536	4,747,155	228,730,662
Creole Petroleum Corporation	4,233,545	310	285	25	2226	589,442*	59,210	51,578,466	25,865,110	378,614,117
Derby Oil Company	11,571	44	25	19	250*	2,447	7,405	2,680,825	268,483	9,957,898
Gulf Oil Corporation		939				367,174	369,582	188,470,464	9,076,200	797,211,423
Houston Oil Company of Texas	843,000				543				1,098,618	13,500,696
Humble Oil and Refining Company	17,400,000	575	445	130	9011	343,200	227,400	253,310,000	17,975,680	724,560,118
Imperial Oil Limited					317		117,900		27,090,590	260,602,339
Lion Oil Company	591,876	69	48	21	429	11,265	17,717	11,217,456	1,170,355	54,250,031
Louisiana Land & Exploration Company		70	46	24	428	92,854			2,975,381	8,261,403
Maracaibo Oil Exploration Company	4,201	12	11	1	294	561			396,000	360,175
Mid-Continent Petroleum Corporation	957,674	217	155	62	1803	19,854	35,415	17,541,795	1,857,912	113,355,627
Ohio Oil Company	2,262,798	211	180	41	7838	90,547	23,745	127,610,903	6,563,377	132,401,320
Pacific Western Oil Corporation	435,398	40	33	7	476	10,134			1,371,730	7,565,067
Pan American Petroleum & Transport Co.	393,410	65	47	18	467	13,430	109,589	42,340,000	4,702,944.5	229,633,425
Panhandle Producing & Refining Company		38	32	6		3,439	4,375		1,488,422	8,651,252
Phillips Petroleum Company	4,435,303	546	455	91	8757	95,180	91,777	65,163,974	6,045,106	302,772,051
Plymouth Oil Company	394,129	32	28	4	613	16,992	10,746●		1,050,000	11,059,719
The Pure Oil Company	2,283,886				6349	70,697	79,675		3,982,031	244,412,577
Quaker State Oil Refining Corporation						2,296	9,392	2,510,586	927,305	42,071,374
Republic Petroleum Company	19,878	13	9	4	131	2,550		953,913	286,700	1,802,920
Richfield Oil Corporation						25,986	70,529		3,989,998	87,957,728
Seaboard Oil Company of Delaware			41			22,444			1,229,230	19,859,415
Shell Union Oil Corporation	3,099,855	366	326	40	9216	218,000	598,000	133,221,682	13,470,625	628,105,170
Sinclair Oil Corporation	5,945,953	226	199	27	6950	79,120	246,548	123,048,293	11,974,021	487,244,609
Skelly Oil Company	2,124,394	295	258	37	4098	48,848	32,123		981,341.8	121,323,798
Socony-Vacuum Oil Company		637†	519†	118†		238,000	460,000	413,000,000	31,178,319	1,043,054,519
Standard Oil Company of California	4,091,019		453		5435	263,103	270,545	155,958,377	13,003,953	530,131,667
Standard Oil Company (Indiana)	8,191,701	509			8351	196,744	370,126	96,678,000	15,284,806	922,810,305
Standard Oil Company (New Jersey)						992,000	1,306,000		27,333,742	2,354,916,766
Standard Oil Company (Ohio)	1,250,384		177		2058	26,372	93,277	2,116,106	3,504,835	198,645,034
Sun Oil Company	7,947,445	507	371	136	3630	90,629	162,738		4,120,684	356,841,425
Sunray Oil Corporation	76,686	161	119	42	2406	34,069	13,449		4,904,647	38,117,795
Superior Oil Company									423,014	36,332,245
The Texas Company										
Texas Gulf Producing Company	130,889	19	12	7		8,866			1,017,340	7,080,917
Texas Pacific Coal and Oil Company	610,030	73	69	4	974		13,139		886,541	9,389,211
Tide Water Associated Oil Company	2,548,500		183		5270	88,481	175,023			
Union Oil Company of California	2,031,753□	310	233	93	2438	76,008	101,304	72,455,000	4,666,270	171,787,585
Wilcox Oil Company	83,222	28	8	20	284	1,941	4,308	2,369,940	280,786	8,145,054

*Includes part interests. †Domestic. ▼Includes purchase of 17 oil wells.
●This is one-half the daily average of the entire year's runs of Republic Oil Refining Company, which is 50% owned by Plymouth. It was shut down 120 days.
‡Includes sales, property and income, etc.; does not include tax on gasoline. □Excludes 55,000,000 prospective acres in Paraguay.
§Does not include federal income tax. The company expects to file a consolidated return which is anticipated to reflect a net loss.

the remainder was used to find new oil reservoirs.

One of the fields in which Plymouth has an interest is in Upton County, Texas, Ellenburger pool, which made headlines as a big discovery. Drilled by Slick-Urschel Oil Company, Plymouth owns half interest is the discovery well and has surrounding leases.

A subsidiary, Republic Oil Refining Company completed repair of its Texas City refinery and in 1948 bought an aviation gasoline plant from WAA for $2,300,000. Work on rehabilitation of facilities is now under way.

● **The Pure Oil Company,** Pure Oil Building, Chicago, Illinois, has in the last 10 years invested $219,000,000 in property and other assets.

An intensified exploration program resulted in finding more oil reserves than the company produced last year. Exploration and development will be aggressively pursued in 1948. Pure Oil is one of those with leases in the Gulf.

The large refinery expansion program is still in progress. The Toledo, Ohio, coke unit was put into operation in 1948. Construction at the Smiths Bluff, Texas, lube plant is in progress, and the specialty naphtha unit there went into operation the first of this year.

● **Quaker State Oil Refining Corporation,** Oil City, Pennsylvania, spent $1,532,000 on capital assets last year, with the largest share going to production and pipe lines.

Expansion of crude oil producing operations is on the schedule if additions of good properties can be obtained. The production department, organized in 1944, is the youngest division of the company. Another fairly new unit is the wax specialties department.

● **Republic Petroleum Company,** Los Angeles, California, is pursuing a development drilling program primarily. The only exploratory work mentioned in the report is being done in an attempt to find deeper production in old shallow wells north of Fillmore, California. Field wells are going down on company properties in Wyoming and New Mexico.

● **Richfield Oil Corporation,** Los Angeles, California, increased and developed its properties by $20,250,000 in 1947.

All Richfield production, which is less than half its refining throughput, is in California. In 1948 exploration work is scheduled to continue in New Mexico but whether exploration drilling will begin on Texas leases is not stated.

● **Seaboard Oil Company of Delaware,** 30 Rockefeller Plaza, New York, is well prepared for continued activity in 1948, which can be expanded because of higher income. Large leases have been acquired and are being studied by the increased staff of the geological department. Seaboard owns a block near the Benedum field, Upton County, Texas.

The company explains another trend that creates higher costs—the desirability of assembling larger blocks upon which to drill so that any reserves discovered can be produced more efficiently.

● **Shell Union Oil Corporation,** 50 West 50th Street, New York, carried out a modernization and expansion program that called for capital expenditures of $138,431,000 in 1947, double the amount used in 1946. Report declares that the company continues to be faced with extensive capital outlays to meet demand.

Expensive development is foreseen for tidelands leases by Shell. It has done considerable pioneering in deep drilling and continues to develop its successful Weeks Island field in Louisiana.

Shell Pipe Line Corporation has a third interest in the new big crude oil carrier that goes from Jal, New Mexico, through West Texas to Cushing, Oklahoma. It is expected to be completed the last of 1948. About the same time shipment of pipe will begin for another crude line from Cushing to Wood River, Illinois. Shell owns 55 per cent of this.

Work under way in the refinery program includes: a new lubricating oil

THEIR PHYSICAL AND FINANCIAL STATISTICS FOR 1947

Company	Net income, 1947	Net income, per share common	Direct taxes, federal, state, and local	Taxes, per share common	Taxes, per cent of net income	Dividends, per share common	Investments, property, plant, equip, net	Total capital assets	Current assets	Current liabilities	Ratio—current assets to liabilities
Amerada	14,919,626	9.46				3.00	23,891,321	52,640,382	26,711,269	7,655,209	3.49
American Republics	2,915,850	1.94	802,677	.54	27.5	.50	13,800,672	30,445,508	16,222,610	2,090,673	7.74
Argo	1,754,328	2.84	722,191	1.17	41.17	2.00	7,031,556	11,712,758	1,576,990	888,909	1.77
Arkansas	4,960,697	48.63	3,003,900	29.44	60.55	6.60	29,413,526	51,387,392	20,990,508	8,206,464	2.56
Atlantic	15,897,852	5.32	14,602,400	5.49	91.85	1.50	224,124,689	329,644,730	96,571,654	39,012,054	2.48
Barnsdall	9,119,031	4.10	3,543,933	1.59	38.86	1.55	23,417,011	41,066,492	17,294,696	5,446,450	3.18
Bishop	347,643	1.01	138,370	.40	39.80	.25	1,837,547	2,347,555	461,359	210,753	2.19
British-American	4,111,479	1.46					59,064,683	99,802,328	37,065,430	12,377,184	2.99
Cities Service	40,464,786	10.93	31,608,779	8.54	78.11	1.50	610,048,637	899,585,227	239,982,496	105,891,674	2.27
Continental	31,356,663	6.61	14,631,723	3.08	46.66	2.50	119,081,476	209,224,483	76,039,077	36,927,224	2.06
Creole	130,750,261	5.06	53,336,507	2.06	40.79	2.85	313,568,324	444,124,492	125,078,081	95,121,731	1.31
Derby	1,196,446	4.46	667,981	2.49	55.83	1.25	3,618,738	6,521,508	2,822,976	1,555,473	1.81
Gulf Oil	95,540,059	10.53	52,773,483	5.82	5.24	2.75	574,100,000		268,916,577	139,375,492	1.93
Houston Oil	4,046,094	3.68	1,833,891	1.67	45.32	1.00	37,826,791	54,310,149	9,955,256	2,743,899	3.63
Humble	124,106,877	6.90	50,546,684	2.81	40.73	3.00	481,690,757	704,163,263	218,419,223	101,937,947	2.14
Imperial	15,903,866	58.71	21,031,719‡	.78	132.24	.50	76,561,041	241,506,772	106,282,041	39,117,251	2.72
Lion Oil	7,991,287	6.83	4,268,880	3.65	53.42	1.75	20,663,888	39,348,196	16,712,994	7,383,578	2.26
Louisiana L. & E.	4,595,530	1.54	2,066,999	.69	44.98	1.00		9,948,262	7,018,242	2,398,328	2.93
Maracaibo	158,073	.40	49,772	.13	31.49	.10	379,403	974,358	253,754	52,973	4.79
Mid-Continent	18,688,932	10.03	13,293,047	7.15	71.32	3.25	24,693,488	115,647,714	62,372,126	20,115,114	3.10
Ohio Oil	29,161,496	4.44	13,830,292	2.11	47.43	1.75	95,083,850	163,773,023	61,447,567	21,108,101	2.91
Pacific Western	3,811,936	2.78	184,863	.13	5.85	.75	14,750,450	33,258,583	4,230,384	1,621,066	2.61
Pan American	14,033,073	2.98	10,342,505	2.20	73.70	.75	93,042,263	167,351,275	70,919,721	34,109,483	2.08
Panhandle	821,169	.55	67,203§	.05	8.18	.15	6,504,699	11,707,776	4,782,288	2,562,254	1.87
Phillips	40,893,647	8.11	22,321,223	3.69	54.58	2.50	291,393,262	439,289,341	116,233,019	52,025,678	2.23
Plymouth	4,197,420	4.01	1,174,394	1.12	27.98	1.00	16,081,039	22,346,212	4,251,803	1,498,973	2.84
Pure Oil	21,197,069	4.77	12,985,114	3.26	61.26	1.50	157,628,084	244,540,177	71,526,853	22,824,622	3.13
Quaker State	2,762,550	2.98	2,276,585	2.46	82.41	1.75	8,740,027	24,699,731	15,015,468	4,143,106	3.62
Republic	602,240	2.10	99,169*	.35	16.47	.375	2,882,888	3,134,837	61,049	1,063,255	.057
Richfield	11,853,397	2.96	7,516,300	1.88	63.41	1.50	60,799,811	109,179,520	43,625,297	14,900,975	2.93
Seaboard	5,941,002	4.83				1.50	8,784,163	22,990,462	11,984,738	3,799,740	3.15
Shell Union	59,874,698	4.44	34,673,000	2.07	46.60	2.25	276,057,900	533,911,823	218,711,715	104,037,890	2.10
Sinclair	48,776,125	4.07	31,618,110	2.64	64.82	1.25	298,370,081	591,280,181	263,519,115	89,540,621	2.94
Skelly	21,090,936	21.49°	6,713,000	6.84	31.83	2.50	88,030,205	128,997,797	39,895,934	18,783,683	2.12
Socony-Vacuum	97,708,927	3.14	57,748,621	1.82	59.10	1.00	637,748,563	1,261,974,200	419,923,647	154,277,476	2.72
Standard of California	107,268,575	8.25	38,068,538	2.93	35.49	3.20	606,011,265	876,185,264	189,491,341	86,217,557	2.20
Standard (Indiana)	94,880,715	6.21	43,774,740	2.86	46.14	2.00	797,689,716	1,268,103,846	334,612,358	138,322,078	2.42
Standard (New Jersey)	268,626,580	9.83	186,560,451	6.83	69.45	4.00	1,524,122,335	2,995,989,693	1,100,562,987	410,494,412	2.68
Standard (Ohio)	16,390,585	4.41	9,947,464△	2.84	60.69	1.375	101,377,991	132,720,389	75,395,384	38,571,386	1.95
Sun Oil	24,339,931	5.81	17,526,940	4.25	70.90	1.00	136,500,595	242,302,954	95,883,486	48,165,168	1.99
Sunray	10,008,611	1.81	4,270,928	.87	42.67	.50	86,186,293	105,110,629	17,194,986	9,171,460	1.87
Superior	4,866,897	11.51	2,302,156	5.44	47.30	2.50	37,491,841	63,262,717	22,048,478	5,119,443	4.31
The Texas Company	106,312,617										
Texas Gulf	2,353,006	2.31	1,106,849	1.09	47.04	.70	13,963,331	16,927,574	2,807,766	2,019,783	1.39
Texas Pacific	4,123,907	4.65	1,375,381	1.55	33.35	2.00	16,252,440	20,658,567	4,325,244	1,191,616	3.63
Tide Water	30,176,000	4.57	16,592,679	2.59	54.99		153,000,270		97,767,000	42,232,000	2.32
Union Oil	18,910,860	3.85	8,364,773	1.79	44.23	1.10	178,407,499	191,131,006	70,894,247	24,765,093	2.86
Wilcox	582,259	2.07	202,340	.72	34.75	.30	3,286,069	5,062,989	1,748,459	919,249	1.90

*Includes adjustments on 1946 taxes.
△Includes $660,000 applicable to special credit in 1946.
°Taxes on income only, less credit of $1,100,000 in 1945 from carry-back; other taxes not credited.
‡As of December.

plant, a wax manufacturing unit, and a new control laboratory at the Houston refinery; facilities for increasing power generation at the Houston and Wood River refineries; and additional facilities for processing cracked distillates at Norco refinery.

In the chemical subsidiary, plants will be completed this year for manufacturing various commercial and semi-commercial products. Enlargements are being made in other chemical units.

In research Shell made contributions in the fields of catalysis, colloid chemistry, and physical chemistry for improvement of fuels, lubricants, asphalts and other products. Chemical agents for agriculture were synthesized for testing at the Agricultural Laboratory near Modesto, California.

New chemicals and processes for manufacture of detergents, plastics, and resins are in various stages of development. Fractionation and purification processes are under study.

● **Sinclair Oil Corporation,** 630 Fifth Avenue, New York, is in the midst of a large expansion program that was planned to cost $90 million in 1945 and may run to $150 million before it is completed.

In southern Oklahoma Sinclair has a 25 per cent interest in a large community gasoline plant now being built to service several fields.

To its network of pipe lines a large carrier is being added from the Houston refinery to St. Louis.

Sinclair owns a fee title to acreage in the oil shale area, lands selected 25 years ago for future production of synthetic fuels. A preliminary survey indicates recoveries as high as 250,000 bbl of shale oil an acre.

In Venezuela work on a new refinery has begun near the Puerta de la Cruz terminal. To be completed in 1951, it will have a daily capacity of 35,000 bbl.

● **Skelly Oil Company,** Tulsa, Oklahoma, increased its fixed assets in 1947 by $24,328,000. During 1947 the company added 52 new oil properties and 39 new gas and condensate properties. This year the continuous program for seeking and developing resources will go ahead as rapidly as possible in view of availability of materials.

Expansions in refining facilities are continuing in 1948, particularly at El Dorado, Kansas, and Longview, Texas.

A new natural gasoline plant is under construction in Stephens County, Oklahoma, to process gas from the Velma field. The Eunice, New Mexico, gasoline plant is being enlarged and plans are made to increase the capacity of the Schafer plant at Skellytown, in the Texas Panhandle.

The Skelly research department has a program of further research to develop new processes and products.

● **Socony-Vacuum Oil Compny, Inc.,** 26 Broadway, New York, made capital investments of $141,400,0000 in 1947, which was expended mostly in the United States, only $19,200,000 being spent abroad, mostly for production in South America. Reports are that the company will spend $440,000,000 for capital assets in 1948 and 1949.

Among its most interesting exploratory projects now in progress is the offshore ocean drilling operations carried on by an affiliate, Magnolia Petroleum.

Socony-Vacuum's share in Iraq Petroleum Company production is expected to double in 1948 to 20,000 bbl daily. The company has production also from Egypt, Venezuela. Colombia, and Sumatra. Exploration operations have been resumed in New Guinea.

The refinery expansion program has been held back by material shortages but the company expects some units to be completed this year and the balance in 1948. Rehabilitation of refineries in France and Italy is going ahead.

A contract was made this year whereby seven large tankers will be built for

the company for 15 years. The ships will be used to transport Middle East and South American crude to U. S. refineries.

Completion is scheduled in June for the 20-in. 647-mile pipe line from Corsicana, Texas, to Patoka, Illinois.

Synthesis of fuels and lubricants is the subject of a large research project of Socony. The natural gas conversion process is said to be nearing competitive status with processing gasoline from crude oil. Lubricating plants of the company will incorporate a new process from removal of asphaltic materials developed by the research department.

The department is also cooperating with manufacturers of oil burning equipment to promote more efficient use of fuel.

● **Standard Oil Company of California,** San Francisco, conducted an exploration and expansion program that cost $148,000,000 in 1947 and may run higher in 1948.

Exploratory effort is proceeding at about the same rate as last year in both hemispheres. Besides the United States, the company's affiliates are interested particularly in the Middle East and Venezuela.

The largest project under way is the crude line of the Trans-Arabian Pipe Line Company (Standard California and Texas).

Unitization plans are being worked out for the California area after cooperative operation plans had been successful here and in other states.

The Bakersfield, California, refinery is being expanded to twice its present capacity. Construction of a new refinery is under way at Salt Lake City and a pipe line is being built from the Rangely field to the refinery.

The Caltex companies have plans to build a 20,000 bbl refinery in Holland, to reconstruct a 13,000 bbl refinery for France, and a 50 per cent participation to build an Eastern Mediterranean refinery.

Activities in Sumatra have been held up by political unrest but the program of rehabilitation is being pursued as well as possible.

Eight tankers have been ordered for delivery in 1948, which will bring the company's fleet to 40 vessels.

● **Standard Oil Company (Indiana),** Chicago, Illinois, reports capital expenditures of $220,000,000 in 1947 and estimate they will be higher in 1948.

Stanolind was interested in the successful Gulf of Mexico wildcat brought in by Kerr-McGee and plans to drill or share in four more tidelands exploratory wells in 1948.

The company has been active in promoting gas conservation and higher recovery of oil through natural gasoline plants and now has some connection with eight new ventures along this line.

Preparations have been made to build a new kind of plant near the Hugoton gas field in Kansas, which will make liquid fuels and chemicals out of natural gas by the hydrocarbon-synthesis process. It is expected to be completed by 1950.

Two chemical plants are also on schedule, one near the Hugoton plant and another at Brownsville, Texas.

The Whiting, Indiana, refinery additions of a second catalytic cracking unit and a converted unit for more crude running were completed in 1948. Still under construction are new facilities for making solvent-extracted oils at Whiting.

A new catalytic cracking unit was added to the Sugar Creek, Missouri, refinery this year and another one is being built at Casper, Wyoming.

Creating synthesis of petroleum products, deriving chemicals from petroleum, improving refining processes, and developing new products have been successful projects of the company's research and all are being continued.

Research for Standard (Indiana), Stanolind, Pan American Petroleum Corporation, and Utah Oil Refining Company totaled $7,000,000.

● **Standard Oil Company (New Jersey),** 30 Rockefeller Plaza, New York, estimates that total investments of the company and its affiliates for 1947 and 1948 will be in excess of one billion dollars. The companies spent $426,000,000 in 1947 for capital outlays and expects to spend more this year.

Important discoveries were made by affiliates in 1947 and are part of the 1948 development program. Imperial's Leduc field in Canada; Creole's extension of Mara production in Venezuela; Humble's preparations for over-water drilling in the Gulf of Mexico; progress toward full production in the damaged Sumatra fields; negotiation for 30 per cent of Saudi Arabia production—these are the signs of growth of supply. This year also saw the company's first importation in the United States of Middle East oil to supply eastern refineries, which were occasionally slowed down by lack of crude oil.

In progress at present is a large refinery expansion program of Esso Standard Oil Company (formerly Standard of New Jersey) on the East Coast and at Baton Rouge, Louisiana. Additions include a new catalyst cracking plant, new pipe stills, and other facilities.

The Carter Oil Company is going ahead with construction of its Billings, Montana, refinery. Imperial and Creole programs have been given previously. Standard-Vacuum's plant at Palembang, Sumatra, is expected to have its throughput stepped up from 20,000 bbl to 45,000 bbl by the end of 1948.

The Italian refinery, confiscated by the government at the beginning of the last war, is expected to be returned sometime this year.

The 1947 fleet of 125 tankers has already had three ocean tankers added this year and contracts have been placed for six tankers that will be the largest in the fleet with 228,000 bbl capacity.

Standard of New Jersey is interested in the Trans-Arabian pipe line and a prospective line from Iranian and Kuwait fields to the Mediterranean coast.

Two new research laboratories were completed in 1948, one at Baton Rouge, Louisiana, and another at Linden, New Jersey. Research costs rose to $18,200,000 in 1947 and work is now expanded.

● **Standard Oil Company (Ohio),** Midland Building, Cleveland, Ohio, in its program for 1948 contemplates the drilling of a larger number of exploration and development wells than last year if steel is available.

The company is the operator of the West Edmond, Oklahoma, unitization plan. A repressuring project for gas condensate in the Benton field near Shreveport, Louisiana, has been put into operation this year. It processes 50 million cu ft of residue gas and 4200 bbl of liquid products a day.

Early this year purchase of two one-ton boats increased the crude oil service to six tows with another one operated in products service.

To reduce the amount of oil in waste water leaving the refinery, a separator is being installed at the Latonia, Kentucky, refinery. A construction program has been launched at the Lima, Ohio, plant, that includes installation of a $11,000,000 catalytic cracking unit. Plans have been made for a solvent refining unit to be built at the Toledo, Ohio, refinery.

● **Sun Oil Company,** Philadelphia, Pennsylvania, reports its 1947 production expansion had successful results, rising 22 per cent between December, 1946, and December, 1947.

The company has a $12,000,000 program for conservation and efficient use of gas resources that began in 1946 and is progressing steadily. It has under construction on behalf of 16 cooperating producers a natural gasoline plant in the Delhi, West Delhi, and Big Creek fields. It is also interested in the Seeligson cycling plant.

The first cargo of crude oil from the Middle East went to Sun's Marcus Hook refinery, which was greatly expanded last year and construction work is still going on. New packaging and compounding facilities, a furfural solvent extraction plant for lubes, a wax plant and other facilities are being added.

This year will see the completion of the pipe line-deep water terminal near Corpus Christi, Texas. It has a million barrels capacity.

In its effort to meet the propane demand Sun Ship fabricated the tank car shells from high tensile steel to add to its shipping facilities. The experience of the company produced an improved method in car construction that saved steel, which is now being studied by the Interstate Commerce Commission.

Sun Science Center at Newtown Square, Pennsylvania, will be the research and development department of the company. Construction of a physical laboratory is now underway. The company spent $4,000,000 last year on research and will expand its program.

● **Sunray Oil Corporation,** Tulsa, Oklahoma, enlarged its geophysical department and a selective exploration program is being carried out.

Sunray has extensive interests in unitized operations being a participant in 16 such programs already in effect and in two that are awaiting plant construction. One of these is the Seeligson field, Texas,

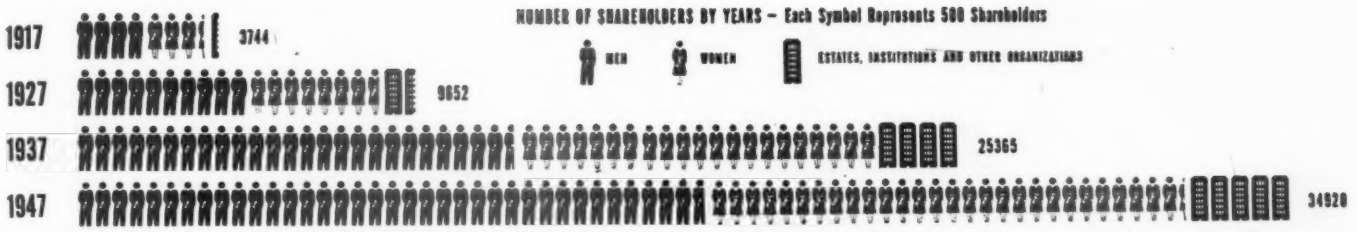


FIG. 6. *Union of California shows growth of the number of its shareholder-owners in 30 years to 34,920. The company has 8138 employes and an investment of $49,200 in "tools" for each employe. Like most oil companies Union Oil has a reputation for good management-employe relations and a high percentage of long term workers.*

unitization facilities and the other is a pressure maintenance unit in Garvin County, Oklahoma.

Refining modernization is being carried out at the former government plant south of Duncan, Oklahoma. Pipe lines and storage facilities are being built to service the plant.

● **The Superior Oil Company,** Los Angeles, California, is one of the producing companies that has taken a lead in strong trend toward unitization of fields with the object of increasing ultimate recovery by repressuring oil sand formations.

Superior properties in several California fields have been unitized with those of other companies for that purpose. The report states that Superior's natural gasoline and cycling plant operations are increasing in importance.

● **The Texas Company,** 135 East 42nd Street, New York, invested some $137,000,000 last year in property, plants, and equipment. Its program for 1948 and 1949 requires another sum of about $375,000,000 for capital expansion. According to a chart in the annual report about $237,000,000 of this will be used this year with expectations of a drop in such needs in 1949.

The company has joined in the vastly increased natural gasoline and cycling plant operations. Two new units in West Texas will add to the 1948 investments.

The company is jointly interested in the Cushing, Oklahoma, to Wood River, Illinois, crude oil pipe line now under construction. It plans also a wholly-owned carrier from Wood River to Salem, Illinois, and another one from Wichita Falls to Corsicana, Texas.

A new refinery is expected to be completed soon at Eagle Point, New Jersey, for oil from Texas and Louisiana and foreign countries. Capacity is set at 40,000 bbl a day.

New lubricating oil equipment and additional furfural refining and solvent dewaxing units are being installed at the Port Arthur, Texas, refinery. Plants at West Tulsa, Oklahoma, and Lanwrenceville, Illinois, are undergoing revisions and having new equipment added with completion expected in 1949.

The Beacon, New York, laboratory is also in an expansion operation. A substantial part of the company's research is devoted to synthesis of motor fuels and chemicals. It is one of the companies contributing to the Massachusetts Institute of Technology program of research in nuclear science and engineering.

The Texas Company foreign holdings are concerned with some of the largest projects in construction, through companies in which they hold usually 50 per cent of the stock. Building of the Trans-Arabian pipe line and expansion of production facilities in Saudia Arabia are estimated to cost $540,000,000 if the present program is completed.

In Venezuela a 157-mile pipe line from new Eastern production centers to Pamatacual is expected to go into operation this year.

Caltex has begun work on a new refinery in Holland and reconstruction of a French plant. An Eastern Mediterranean refinery is planned.

Wholly-owned subsidiaries are pushing exploration and production in Colombia and Venezuela.

● **Texas Gulf Producing Company,** Oil and Gas Building, Houston, Texas, said its exploration program was curtailed by shortage of tubular goods throughout last year. Steel shortage is considered an obstacle to the 1948 program of further development work and wildcat operations.

● **Texas Pacific Coal & Oil Company,** Fort Worth, Texas, producing firm, will carry on an active geophysical program and continue further development of its properties in 1948.

● **Tide Water Associated Oil Company,** 17 Battery Place, New York, reports gross capital expenditures of $34,481,000. During the six years ending in 1947 capital expenditures have totaled $145,000,000.

Large areas added in 1947 will require the launching of an extensive prospecting program this year.

● **Union Oil Company of California,** San Francisco, is carrying on an intense exploration and development program in 1948. Three geophysical crews are at work in Paraguay and drilling is going ahead. Canada and the State of Washington are also in the exploration program.

At the Oleum refinery near San Francisco an $8,000,000 expansion program is underway. A new plant for solvent treatment of lubricating oils will be installed and the vacuum distillation and propane dewaxing equipment will be improved.

The Oleum office building, compounding and shipping facilities are being modernized and a new warehouse constructed.

The research department is supervising the construction of a second commercial hypersorption unit, having developed the process to separate component parts of petroleum and other gases. It has also developed what the company believes is one of the most economical methods of producing oil from shale.

Control materials for various insect pests are under study as well as chemical products useful in making plastics.

One important project of the research branch is development of better secondary recovery methods.

● **Wilcox Oil Company,** Tulsa, Oklahoma, made a total outlay of $548,678 in 1947 for property and equipment.

The company made remarkable gains in all departments last year increasing production 14 per cent, runs to stills 56 per cent, refinery products 48 per cent, and gas sales 35 per cent.

● **Report booklets.** The evolution of annual reports in our opinion is worth a book. In a comparatively short time they have progressed from a set of figures unreadable to an average stockholder to a very human account of a company's activities and plans for the future with satisfying and understandable graphs and pictures. Most of them are well worth reading and you don't have to be able to add or subtract to learn what is going on. Many of the reports are models of typographical excellence.

This change is partly due to the growth of shareholders, extending into groups that know little about the oil industry and are bored by figures. Union Oil Company of California depicts the trend toward wider diversification of ownership by a graph. (Fig. 6).

Besides the account of the heroic job done by the oil industry in 1947 there are such interesting sidelights as Sun Oil's new processing oil to make nylon hose less likely to run and the Pan American Petroleum tanker's sea rescue of eight survivors of a burning Cuban schooner off the Atlantic Coast.

Just once we shall step outside the oil industry to look at an unusual report. Allegheny Ludlum Steel Corporation did a cartooning job with its annual report that wouldn't leave a fourth grader in doubt about its finances in 1947. Al, the cartoon character representing the company, was obviously happy about the income, looked pretty serious over what he paid out for supplies and sad over taxes, distributed wages and salaries and dividends with a grin, worried over fitting what he had left to improvements needed and ended up in front of a pawnshop with the blurb "Shall I go in?" ★ ★

AT THE TULSA SHOW . . .

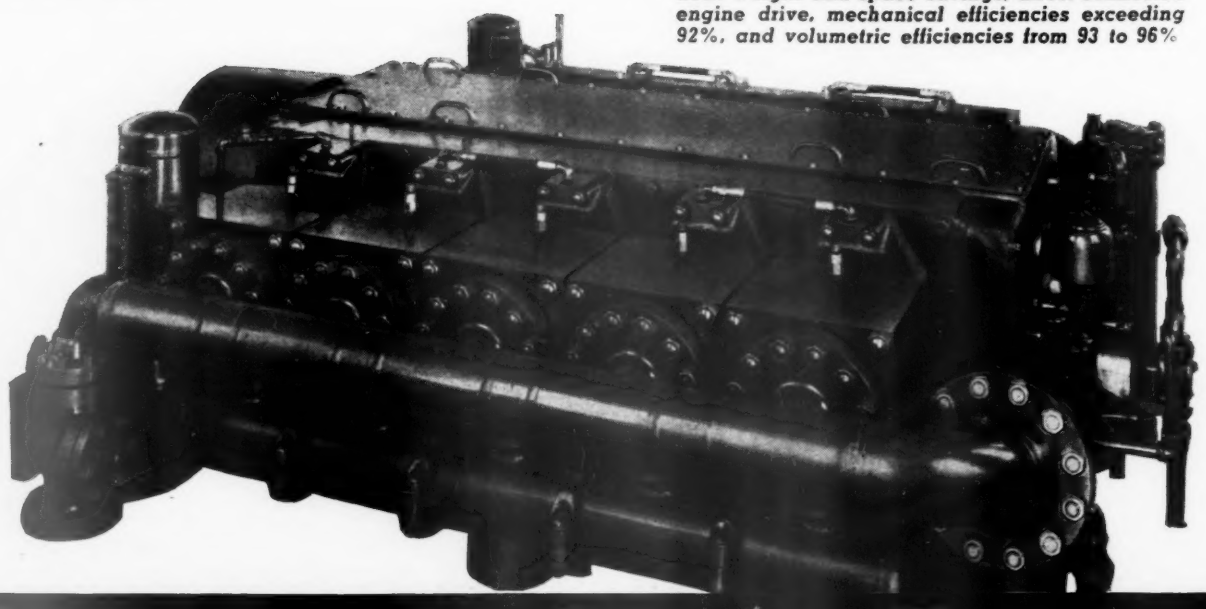
See these COOPER-BESSEMERS.. they're making News!

You'll see a lot of your friends at the Cooper-Bessemer I.P.E. Building. They, and perhaps you too, will want to get a good look at these recently developed units that are already setting new records in efficient, low-cost compressing and pumping.

The Cooper-Bessemer men on hand will welcome your visits, will be glad to tell you all about these new units. They'll also be able to give you interesting information on other major Cooper-Bessemer developments . . . such as the *Turboflow* V-angle compressors with their incomparable fuel and space economy . . . and our latest gas-diesel refinement offering high efficiencies even at *fractional* loads!

Yes, if you're interested in *new* things, in new developments that add up to lower operating cost, we'll make your Cooper-Bessemer visit well worth your time.

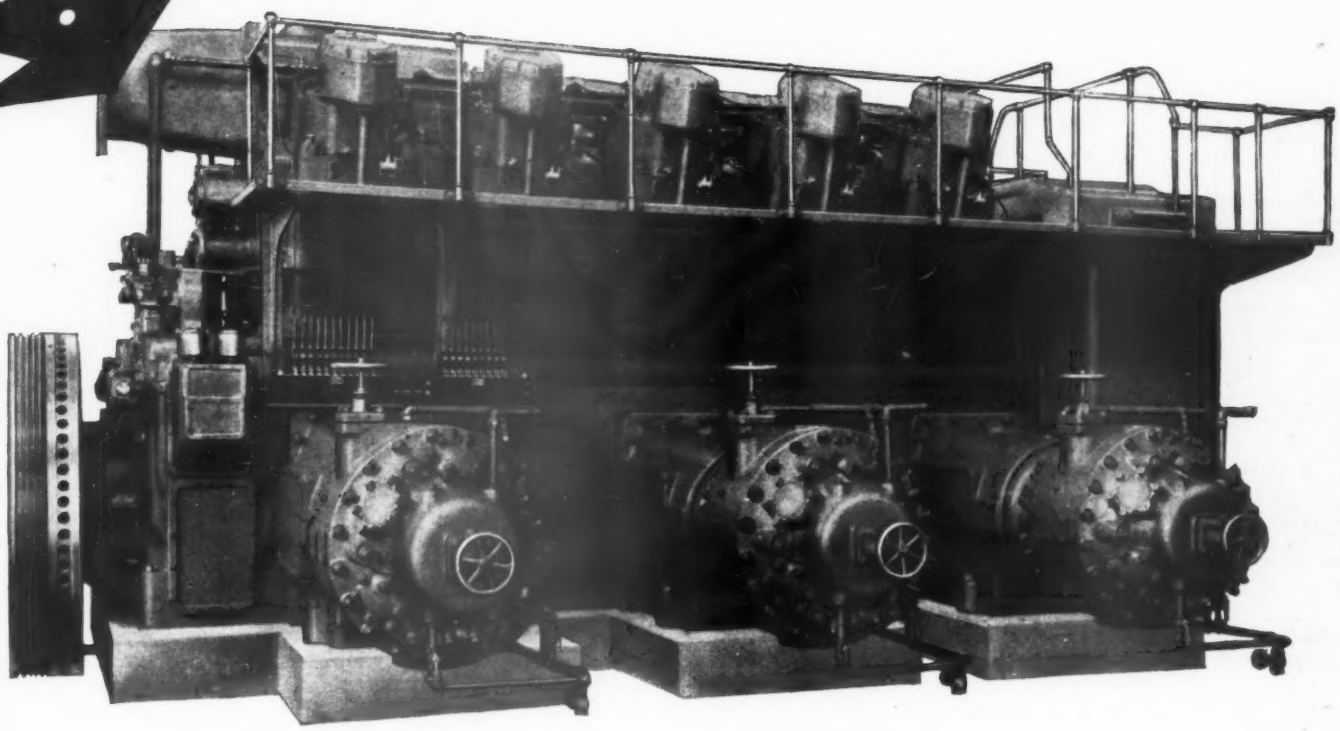
Cooper-Bessemer Twin-Line liquid pump. Designed for capacities from 2400 to 50,000 barrels a day, up to 2,000 psi discharge. Offers tremendous weight and space savings, direct-connected engine drive, mechanical efficiencies exceeding 92%, and volumetric efficiencies from 93 to 96%



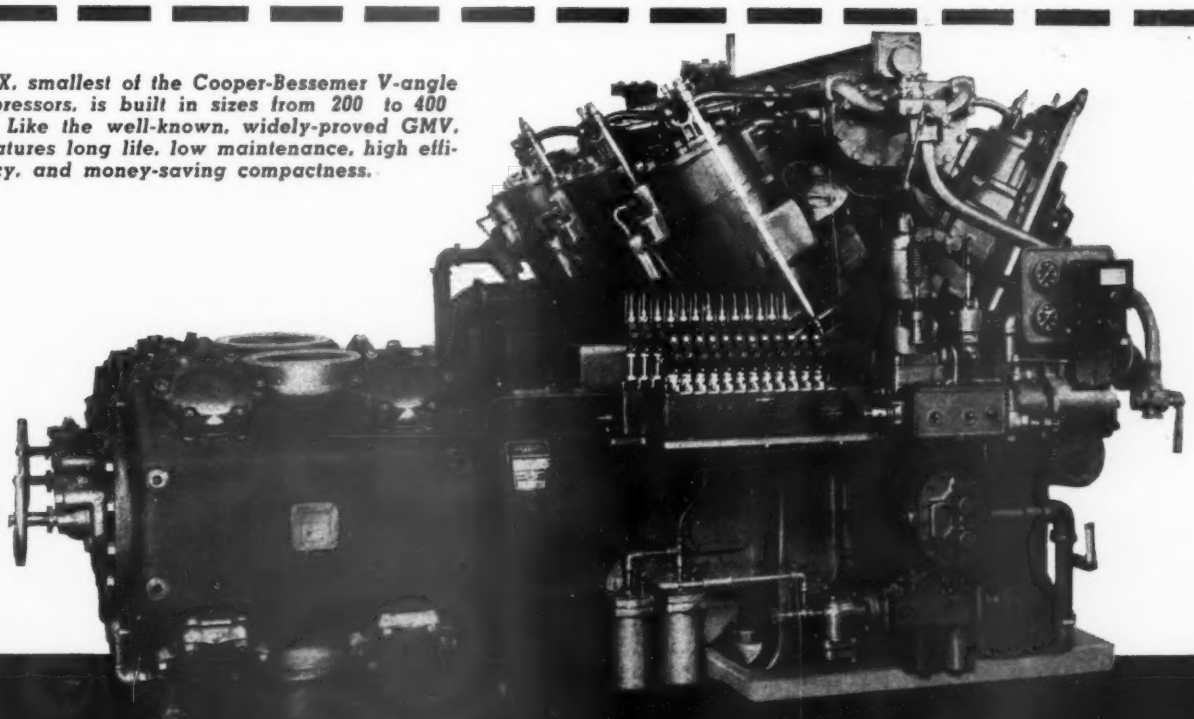
Compressors · Pumps · Engines

New York Washington Bradford, Pa. Parkersburg, W. Va. San Francisco, Cal. Seattle, Wash. Ho

Cooper-Bessemer 10-cylinder GMW V-engine-driven compressor, industry's most powerful angle unit, rated 2400 hp at 250 rpm. Features big savings in space, housing, installation and operating costs.



GMX, smallest of the Cooper-Bessemer V-angle compressors, is built in sizes from 200 to 400 bhp. Like the well-known, widely-proved GMV, it features long life, low maintenance, high efficiency, and money-saving compactness.



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Oil mining in Europe

By A. E. GUNTHER, The Shell Petroleum Company, Ltd.

● **Introduction.** The recovery of crude oil by excavation is as old as civilization. The transition from the earliest diggings at the site of seepages to the sinking of holes to considerable depths and even to primitive mining by adits and galleries, is not a development likely to find an accurate record in history. In Europe the date taken for the first systematic recovery of crude oil by mining appears in the second half of the 18th century, when considerable activity was focused on the site of the tar pits of Pechelbronn in Alsace, already recorded, like other oil occurrences in Europe, in the literature of the Middle Ages. In 1765 the Pechelbronn galleries were said to be 1500 ft long and pits were sunk to depths of 160 ft; but whatever the early developments at Pechelbronn or elsewhere, the systematic mining for oil by mechanically operated shafts and galleries is a development of this century. It was begun by the Germans at Pechelbronn during the First World War and after it was introduced into the Wietze oil field in Hannover Province of Northwest Germany. It emerged out of the German oil shortage of 1916 and may be said to have justified itself economically between the wars by the prevailing policy of national self-sufficiency, with its insistence upon the development of indigenous sources of basic commodities, crude oil among them. By the First War the Pechelbronn oil fields, which since 1870 had been in German hands, and which since 1906 had been under the operation of the predecessors of the Deutsche Erdoel, was in an advanced stage of development. To procure the increase of production urgently needed for war purposes, the Germans began the sinking of mining shafts that were continued by the French after the war. By 1924 there were three mines with double shafts and a fourth left unfinished.

EXCLUSIVE

● **Mining methods.** Modern mining aims to recover crude oil that cannot be recovered from a sand by methods controlled from the surface. Depletion by pumping wells in the Pechelbronn field amounts to about one-sixth; drainage by mining results in a depletion of about one-third; by mining the oil can be removed altogether from the sand.

The Germans in their first experiments at Pechelbronn attempted three methods of recovery:

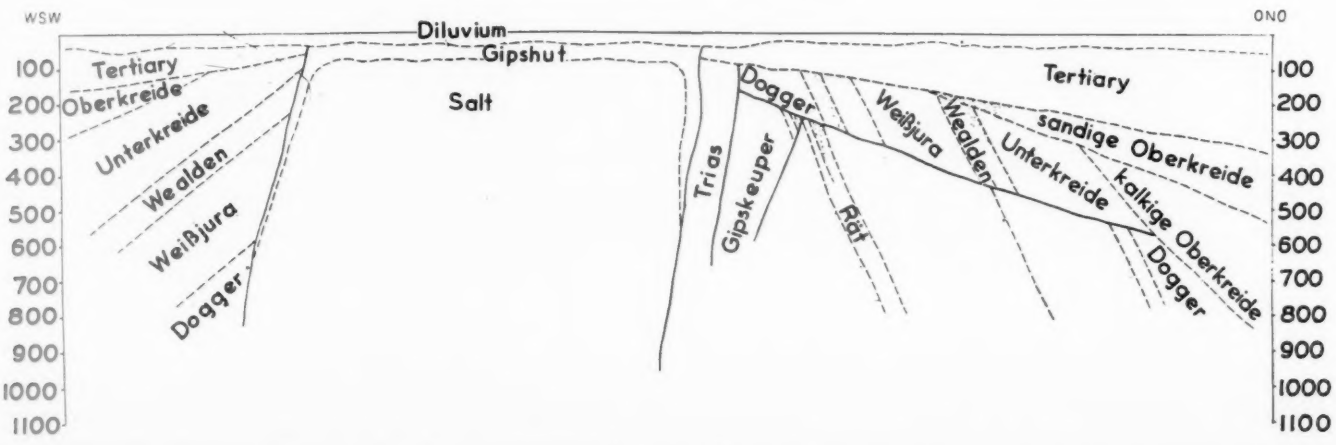
1. Removing the oil sand and steaming out the oil at the surface.
2. Tunneling into the oil sand and collecting the oil from drains and pits.
3. Tunneling into the beds above the oil sand and sinking pits into it from which the oil was pumped.

The first method, now known as the "direct," or Wietze Method, from its systematic application in the Wietze oil field, was tried by the Germans but was not continued, on the grounds that the light Pechelbronn oil (lighter than the Wietze oil) could be extracted by draining to its economic limit. The second and third methods are known as "indirect" methods of recovery. The second method, tunneling in the oil sand, was likewise tried by the Germans but given up by the French after a serious explosion. But the determining factor against this method was the hardness of the sandstone, which made the galleries more expensive to run than in the overlying marl. It is the third method that has come to stay and that is known as the "Pechelbronn method," at present also applied in the exploitation of the Rhaetic at Wietze.

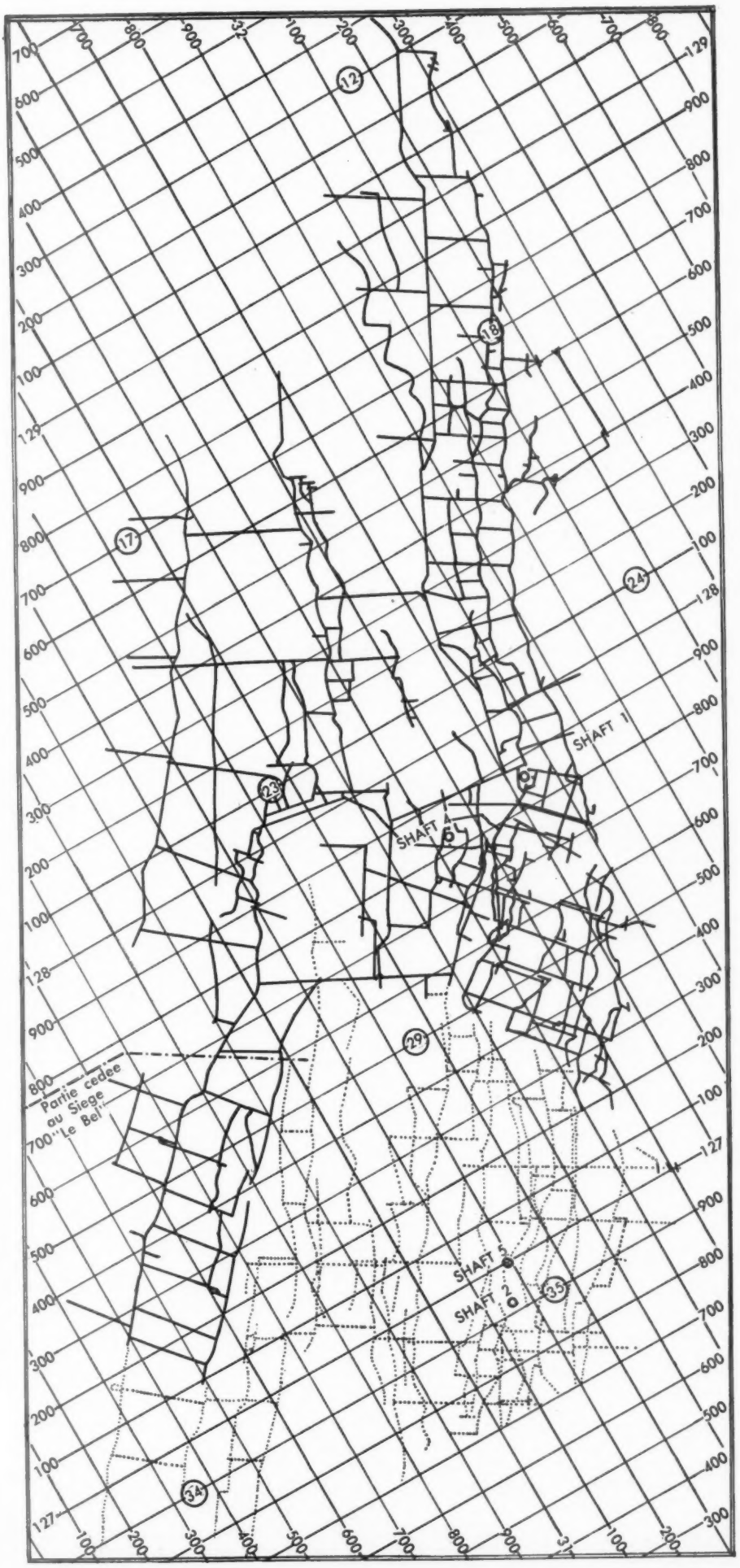
● **Alsace: Pechelbronn. Geology and structure.** The geology of the Pechelbronn oil field region has long been known. The development of the war years has added little to it except in the systematic application of existing data. The field lies on the west margin of the Upper Rhine Graben, where the West Boundary Fault divides into a system of faults forming the crescent-shaped Zabern depression. The field represents a purely faulted type of structure with no folding at all. It is cut by numerous SSW-NNE faults (Rhenish trend) dipping about 45° to the West. The SE dip (5-15°) of the beds is almost negatived by the succession of faulted blocks. There are only a few cross-faults. Oil has been trapped by the fault system and has accumulated in the higher parts of the slightly tilted blocks. The deeper parts carry water.

The Pechelbronn oil fields are thus situated on a west high block of the regional Zabern-Kraichgau Depression striking obliquely across the Rhine Graben to the German oil fields of Forst-Weiher and Weingarten. Synclines lie to north and south of the Pechelbronn high; to the north the Pfalzburg-Langenbrucker syncline; to the south the Zorntal syncline, which rises farther south in the Truchtersheim area.

Cross-section of the Wietze oil field.



Schematic outline of tunnels in the Clemenceau oil field.



Oil is found mainly in Oligocene beds, (Meletta sandstones, Pechelbronn beds) but also in Eocene, Dogger, and Lower Keuper. The number of producing horizons in the sands and sandstones of the Lower Pechelbronn beds varies between 8 and 13. The thickness of a single sand horizon is 0.3-0.5 meters (.98 to 1.64 ft) and it may change into a marl within a short distance. The oil sands thus form smaller or larger irregular lenses.

● **Pechelbronn mines.** Between 1916 and 1924 in the Pechelbronn oil fields three mines with double shafts had been completed. A fourth shaft had been started but was not completed owing to the difficulty of penetrating water sands. In June, 1940, at the time of the German invasion, the three mines comprised some 300 kms (186½ mi) of galleries. The extent of development in 1940 may be summarized as follows:

	Shafts*	Layers exploited	Depth of layers	Length of galleries
Clemenceau	I IV	2	154 & 208 meters (505 & 682 ft)	100 kms (62 mi)
Le Bel.....	II V	3	230 & 415 meters (754 & 1311 ft)	110 kms (68 mi)
Daniel Mieg	III VII	2	200 & 400 meters (656 & 1312 ft)	89 kms (55 mi)
	VI	1	400 meters (1312 ft)	1 km (1 mi)
				300 kms (186 mi)

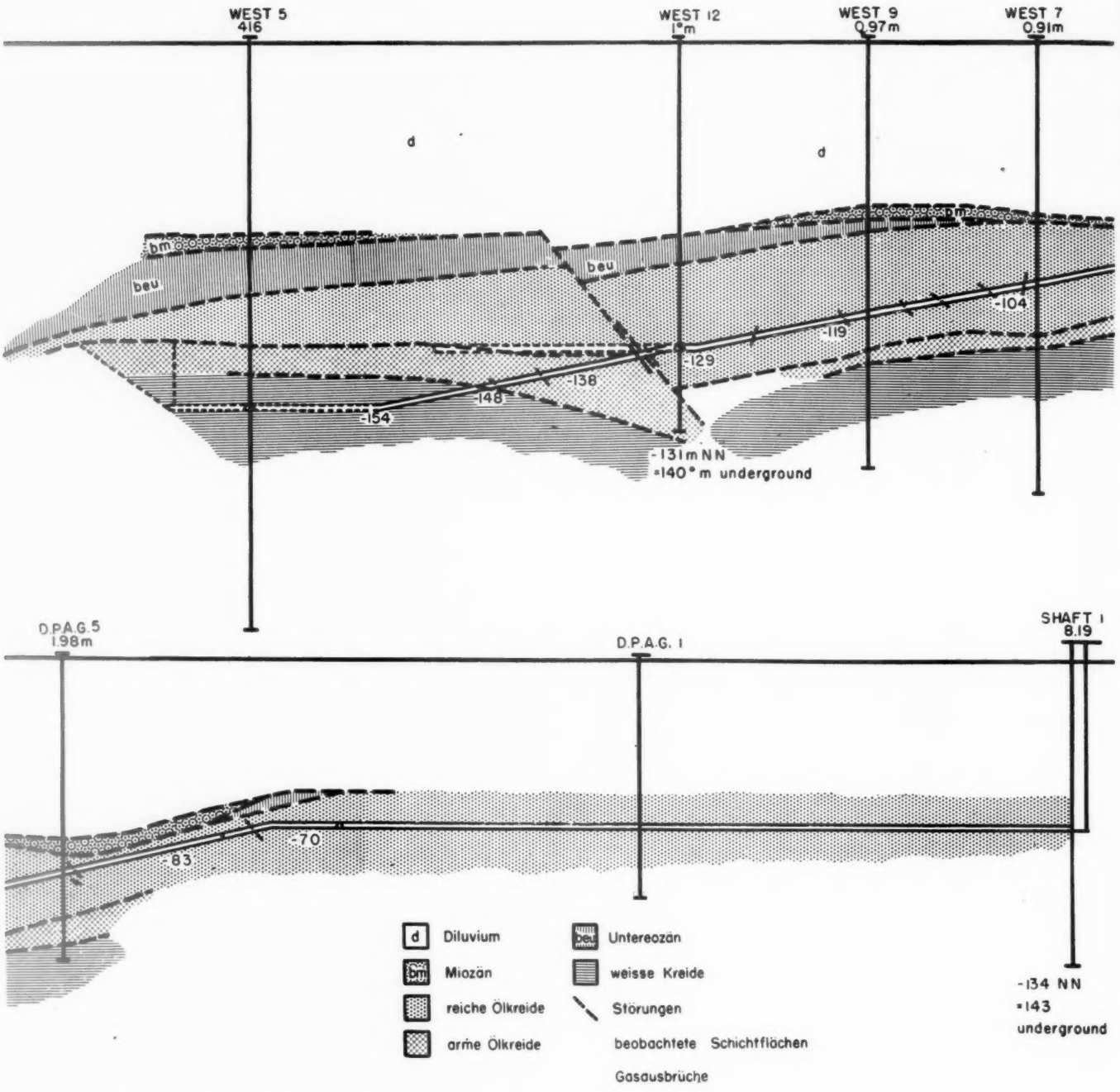
*Each mine, except No. VI, has two shafts, the larger for operation and the smaller for ventilation, as required by law for mines of a certain size. The second number, IV, V, or VII, represents the ventilation shaft.

In 1938 the French had driven an inclined adit called Stollen Georg (N.E. of Shaft I-IV) from the surface 170 meters (560 ft) to Upper Clemenceau level at +25 meters (82 ft), both for the purpose of ventilation and to exploit a sand at +100 meters (328 ft). It may be noted in passing that on the German invasion of 1940, the French blew in the three mine shafts but omitted to destroy the Stollen Georg, which gave the Germans easy access to the Clemenceau mine.

The construction of Shaft VI was stopped in 1924 by a water-sand zone at 122-150 meters (400-492 ft) depth. The attempt to exploit the area from Shaft I-IV led to difficulties and in 1936 the sinking of Shaft VI was continued. At the time of the German occupation the shaft had reached a second group of water sands at 253 meters (830 ft) and the French planned to apply the freezing method. This the Germans carried out and completed the shaft to a depth of 400 meters (1312 ft) in 1943. Galleries were started

Abbreviations used are:

1 hectare = 2.471 acres
1 meter = 3.281 ft
1 kilometer = 0.6214 mi
Cu m = 6.2905 bbl (42 U. S. gal)
Tons = 6.539 (av grav 32.5 API) bbl
Tons/hectare = 2.93 bbl/acre



Heide-Meldorf oil field showing geological section through mine for oil chalk, 1945.

and the first production was obtained in January 1944.

● **Production.** Production from the mines began in 1917. By the middle of the 1920's it was about 50 per cent of total production. On the German withdrawal in the autumn of 1944 the total production of wells and mines was as follows:

Wells	1,839,340 tons
	(13,350,000 bbl)
Mines	742,566 tons
	(5,380,000 bbl)
Total	18,730,000 bbl

In the ten years before the war the production from all the Pechelbronn fields averaged about 73,000 tons (530,000 bbl), of which 40-45 per cent was mined oil. Owing to destruction by the French in May, 1940, total production during the war years average some 60,000 tons (442,000 bbl) and mined production about 35-40 per cent of the total. Most of the mined oil is light, with a specific gravity of 0.86-0.88, with paraffin base.

0.87 = 31.1°API = 304 lb / bbl = 7.25 bbl/ton of 2240 lb

● **Hannover-Wietze.** It is a matter for comment that whereas mining for oil in Alsace is often heard of, the Wietze development is less known. After the First War the Deutsche Erdoel brought their Pechelbronn technique to Wietze and there began a profitable enterprise. The Wietze field is the oldest field in Germany and has been producing since 1873. In size it is second only to Nienhagen, having produced in all 2,262,672 tons, partly by pumping and partly by mining:

From wells	1,672,026 tons
From mine	590,646 tons

Mining production began in 1919 and by 1925 was accounting for 50 per cent of current field production. With the gradual decline of the field since 1930,

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Baash-Ross News

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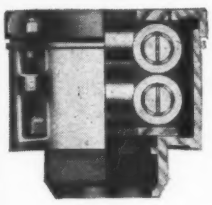

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SEE the many unique features of Baash-Ross Roller Kelly Bushings ... their *double* roller design for maximum stability, their ready adaptability to various kelly sizes, their reversible pins, replaceable bronze bushings and many other important advantages. Available for both *Square* and *Hexagon* Kellys. On display by ...

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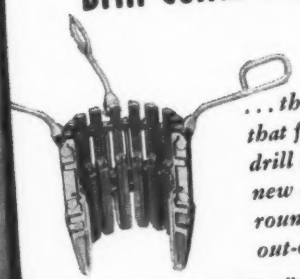
BAASH-ROSS Drill Collar Slips



... the slips that fit any drill collar— new or worn, round or out-of-round!

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- Light and easy for crew to handle!
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Baash-Ross Drill Collar Slips are available in two types—"Regular" type and "Long" type with extensions for use with Baash-Ross Safety Clamp. See them at ...

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BAASH-ROSS "DU" Rotary Slips

... the Unitized Slips that combine every important feature for supporting drill pipe and tubing!

- Unitized for permanent alignment — always set uniformly to safeguard pipe against damage!
- Unusually light in weight for maximum convenience to crew!
- Each body size readily adaptable to many pipe sizes by simply changing liners!
- Segmented liners fit both "Regular" and "Long" body lengths ... simplify maintenance, reduce inventories, protect pipe against marking!
- Liners retained by unique "keyed" design that transmits all stresses directly to bodies. Nothing to shear or drop into hole!
- Available in both "Regular" (12") and "Long" (16") body lengths!

There are many other valuable features. See Baash-Ross "DU" Slips at ...

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- Choice of eleven different sizes ... 1, 2 or 3 sheave models with 20", 24" or 30" sheaves, and 4 sheave models with 30" or 36" sheaves!
- Also all sizes are available in a "Hinged" type where unusually fast line threading is desired!

These Blocks are revolutionizing portable rig operations. Don't miss them. On display at ...

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... the Clamp that protects drill collars and other flush joint equipment against dropping!

- Simply wrap around pipe and cinch tight with quick-acting socket wrench. Each individual segment takes firm slip-proof grip that automatically wedges tighter as load increases.
- Readily adaptable to various pipe sizes by simply adding or removing links.
- Two basic sizes—Type "Y" for pipe sizes 1¼" to 4½" ... Type "C" for pipe sizes 3¾" up.

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Here is the ideal combination for all modern casing operations.

- Casing Spider can be placed on any rotary table ... or on a platform that replaces rotary table ... or on cribbing—whichever is most convenient!
- Spider is in two parts, hinged together for maximum speed and convenience in placing around casing. Also simplifies handling and transporting!
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- "UC" Casing Slips are segmented for uniform, non-crushing grip on pipe!
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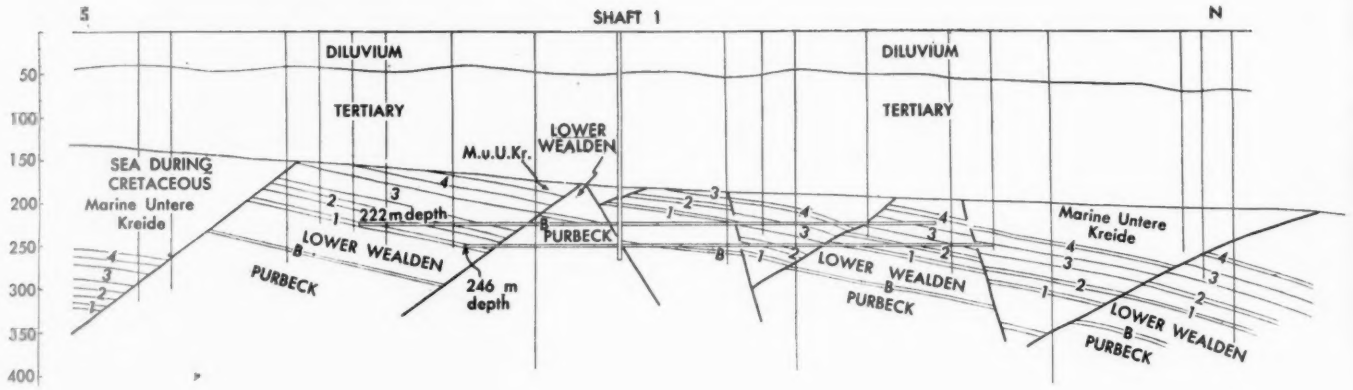

Cross-section of Wealden-Lager von Wietze.

an increased proportion of oil has come from mining—55 per cent in 1933, 78 per cent in 1944. Wietze now averages about 3000 tons a month. Of the 2000 tons a month obtained by mining, a third is obtained by "direct" and two-thirds by "indirect" methods (described under mining methods), all from one mine.

● **Geology and structure.** The geology and structure of the Wietze oil field is well known and the last years have added little to it. The field lies on the WNW plunging nose of the Steinfoerde-Wietze salt dome, striking parallel with the Aller River tectonic line. The flanks of the nose are not symmetrical. The SW flank dips undisturbed at 35°; on the NE flank a drag-zone of steep Triassic separates the salt from mesozoic beds cut into High and Low blocks by a pre-Cretaceous overthrust, further complicated by faults and unconformities.

Oil is found in well-developed sands and sandstones on both SW and NE flanks of the plunging nose in Rhaetic, Cornbrash (Dogger), Wealden, and Upper Cretaceous. The main sands are Wealden and Cornbrash. Mining is confined to the NE flank in Rhaetic and Wealden sands.

● **Mining methods.** At Wietze mining operations are carried out at depths from 165 meters (410 ft) to 325 meters (1067 ft) in Wealden sands and in Rhaetic sandstones. The Wealden sands in the oldest part of the field, where they have long since been exhausted by pumping wells, are treated by the "direct" method, that is of removal. There are four sands within a total formation thickness of 40 meters (131 ft), lying at depths of from 150 meters (492 ft) to 250 meters (820 ft); at present the second sand is being mined. The upper sand in the southern section has already been removed. Mining is done by the "Long Wall" method, the working face being 80 meters (262 ft) long and about 2.4 meters (7.9 ft) high. The sand is a loose, fine, slightly clayey sand containing 20-25 per cent oil by volume (equivalent to 11 per cent by wt. of oil or 1745 bbl per acre-ft). About 350 tons of sand are mined per day. (About 250 bbl per day). A conveyor belt system carries the mined sand to the bottom of the shaft where it is filled into tubs and hoisted to the surface. The belt system also conveys washed sand, pit props, etc., to the working face. The washed sand is tightly packed in the mined-out area behind the working face. A simple method of returning the washed sand underground has been adopted. It is merely dumped down disused wells, together with pit props, etc., to the topmost level, from which it is passed on to the working face by conveyor belt. At first abandoned wells were used, but latterly a well with 13⅜-in. casing was drilled for the purpose.

The "indirect" method, successful at Pechelbronn, is being applied to the less exhausted Dogger and Rhaetic sands and sandstones. Main galleries are driven through the sand bodies, and laterals, spaced at 10 meters (32.8 ft) interval, ensure maximum recovery. Owing to the varying dips of the strata, these follow somewhat tortuous courses. Channels are dug in the floor and collecting pits are spaced at intervals, into which the oil drains. From these it is pumped into a 2-in. pipe gathering system by float-controlled automatic displacement pumps operated by compressed air. In the hard Rhaetic sandstone 2-3-in. holes are drilled also from galleries cut in the shale adjacent to the oil layer. The specific gravity of the Rhaetic oil (sp gr 0.880, paraffin base) (29.3° API) ensures adequate recovery. The Wealden oil is heavier, having a specific gravity of 0.937-0.951 (19.5°-17.3° API) asphaltic and mixed base, making removal necessary.

The total length of the galleries in the Wietze mine is about 58 kms (36 miles). Safety lamps are used, for the mine is not entirely free of explosive gas mixtures.

Wealden sand:

18.4° API = 7.861 lb per gal
= 330 lb per bbl
= 6.68 bbl per ton

Rhaetic ss:

29.3° API = 7.328 lb per gal
= 308 lb per bbl
= 7.166 bbl per ton

Pechelbronn crude oil mines—position 1938-1945

	Clemenceau I	Clemenceau IV	Le Bel II	Le Bel V	Daniel Mieg III	Daniel Mieg VII	Total
Depth of shafts, ms	151	210	400	230	200	400	
Length of galleries, kms	100		110		89		299
Galleries driven—1938, kms	5,302		6,466		8,906		20,692
1939, kms	4,042		5,747		7,849		17,639
1940, kms	2,098		2,136		2,748		6,984
1941, kms	2,516		2,162		1,052		5,731
1942, kms	3,121		5,294		3,613		12,029*
1943, kms	2,956		4,730		4,194		12,402/
							75,477
Drainage area, ha	487		441		420		1,359
Production—1938.....Oil, cu m	10,000		11,900		8,100		29,900†
Water, cu m	53,000		16,100		9,200		78,400
Total fluid, cu m	63,000		28,000		17,300		108,300
1939, tons	9,239		11,399		9,548		30,187
1940, tons	7,258		7,051		5,182		19,491
1941, tons	8,526		8,240		6,752		23,520
1942, tons	8,860		9,608		7,434		25,903\‡
1943, tons	9,066		9,569		5,487		24,122/
Production, tons per hectare—1936	609		465		344		486 avg\
1937	600		470		350		484 avg\§
1938	590		475		334		475 avg/
Production, tons per meter of galleries—1936	2.1		1.6		1.2		1.6
1937	2.8		2.0		1.7		2.2
1938	2.8		2.0		1.6		2.1
Cost per 100 kg crude	80 Fr.		..		..		..
Labor force, men	300●		329		350		1,100▲

*40,000 ft per yr. †188,000 bbl/yr. ‡184,500 bbl/yr. §1436 bbl/acre/yr. ●222 bbl/man yr. ▲168 bbl/man yr.

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When brought to the surface the wet sand is charged (after screening to remove concretions) into one of three conical-bottomed washers of 20 cu m (125 bbl) capacity. The sand is mixed with water, heated and agitated by steam for about two hours. The temperature of the mixture is raised to about 200 F and this procedure is sufficient to wash out most of the oil, which is floated off the top. The contents of the washer are then dumped into tanks, where a little more oil is recovered. A part of the washed sand is put into buckets for dumping down the mine.

● **Costs.** The question of the economics of oil mining is not a simple one. The method cannot always be seen as the last of a logical series passing from flowing, gas-lift to pumping, and so on. Profitability depends also on the extent to which the sand has been drained by other methods. Costs are affected by related activities. Mining may not be justified if considered apart from other methods of production. Similarly, "direct" or "indirect" methods may not be justified by themselves. At Wietze the "direct" method requires the financial support of the "indirect" method; and mining as a whole requires that a share of the overhead be set against a wider background. The advantage of mining to the Deutsche Erdoel is that it gives a hard core of production on which the company can absolutely depend for a known length of time.

The following figures will give some idea of the costs involved for 1944:

Wietze field	Reich marks per ton
825 bbl per day oil—Mining "indirect" method, 76.7 per cent	60.00
350 tons sd. per day, 250 bbl per day oil—Mining "direct" method, 23.3 per cent	120.00
Average	74.00
Wells, pumping	56.00
Wesendorf field	
Wells, flowing	45.00

Mining has already been in progress at Wietze for 25 years. Within 10 years it is anticipated that oil in the areas of the "indirect" mining method will have become exhausted to the extent that it will not afford economic support for the "direct" method. The reserves from pumping wells are placed at 90,000 tons (644,000 bbl); from mining 118,000 tons (832,000 bbl). The technical difficulties of oil sand mining are considerable and not everywhere is there the experience either in labor or in management for a highly specialized technique.

Subsidence at the surface is already considerable. The ground level above the mine has dropped some 3 meters (9.8 ft). Cracks have appeared in the buildings and the factory chimney has assumed a lean of 0.50 meters (1.64 ft) from the vertical.

● **Heide Meldorf.** During the Second War, to meet the needs of the German Navy for fuel oil, the Deutsche Erdoel, who operated the Heide Meldorf oil fields, undertook, under pressure, to continue the mining of the oil-saturated chalk, first unsuccessfully attempted in the 1920's. The German Mobilization Plan estimates of 1938 had put the oil chalk reserves of this structure at 4,000,000 tons (25,000,000 bbl). In 1941, after prolonged discussion, the Navy undertook to subsidize the venture to the extent of RM.4,000,000 in the first instance and later guaranteed to refund all costs should the venture fail.

The attempt to mine the oil chalk met with technical difficulties from the start. The much fractured chalk formation, lubricated by the oil, is highly plastic. It can be squeezed in the hand and a pile of it will settle down under its own weight. In a mine, under the pressure of an overburden, it will "flow." The difficulty of driving galleries through it, though not impossible, was slow, dangerous, and very expensive. The cost of driving galleries at Wietze was RM.80 per meter; at Heide-Meldorf, RM.1000 or more. There were also troubles with gas, and, but for the Navy's insistence, the Deutsche Erdoel would not have begun the venture let alone continued it, especially as the war delayed the arrival of essential materials for construction. By 1945 a shaft 70 meters (230 ft) deep had been sunk and a gallery about 800 meters (2600 ft) long constructed. A twin distillation plant was nearing completion, in which experiments had been started. By 1945 the costs had already exceeded Rm.8,000,000, but the Navy received not a ton of oil. ★★★

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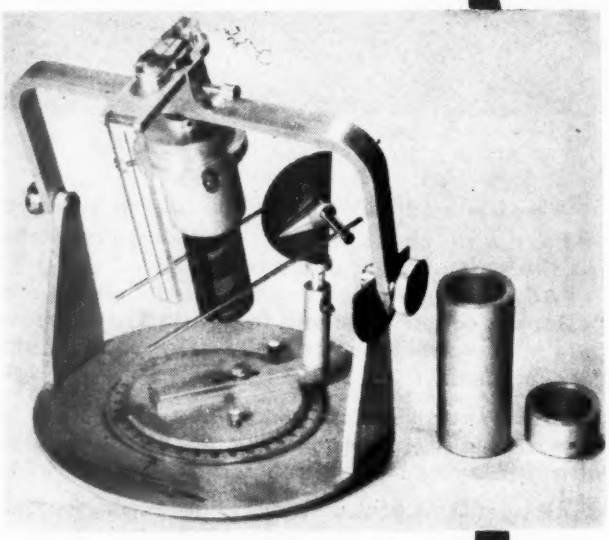

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Air view of Arkansas Fuel Oil Company's new gasoline plant in Panola County, East Texas.

New gasoline plant for Carthage field

By DON ATTAWAY, Arkansas Fuel Oil Company

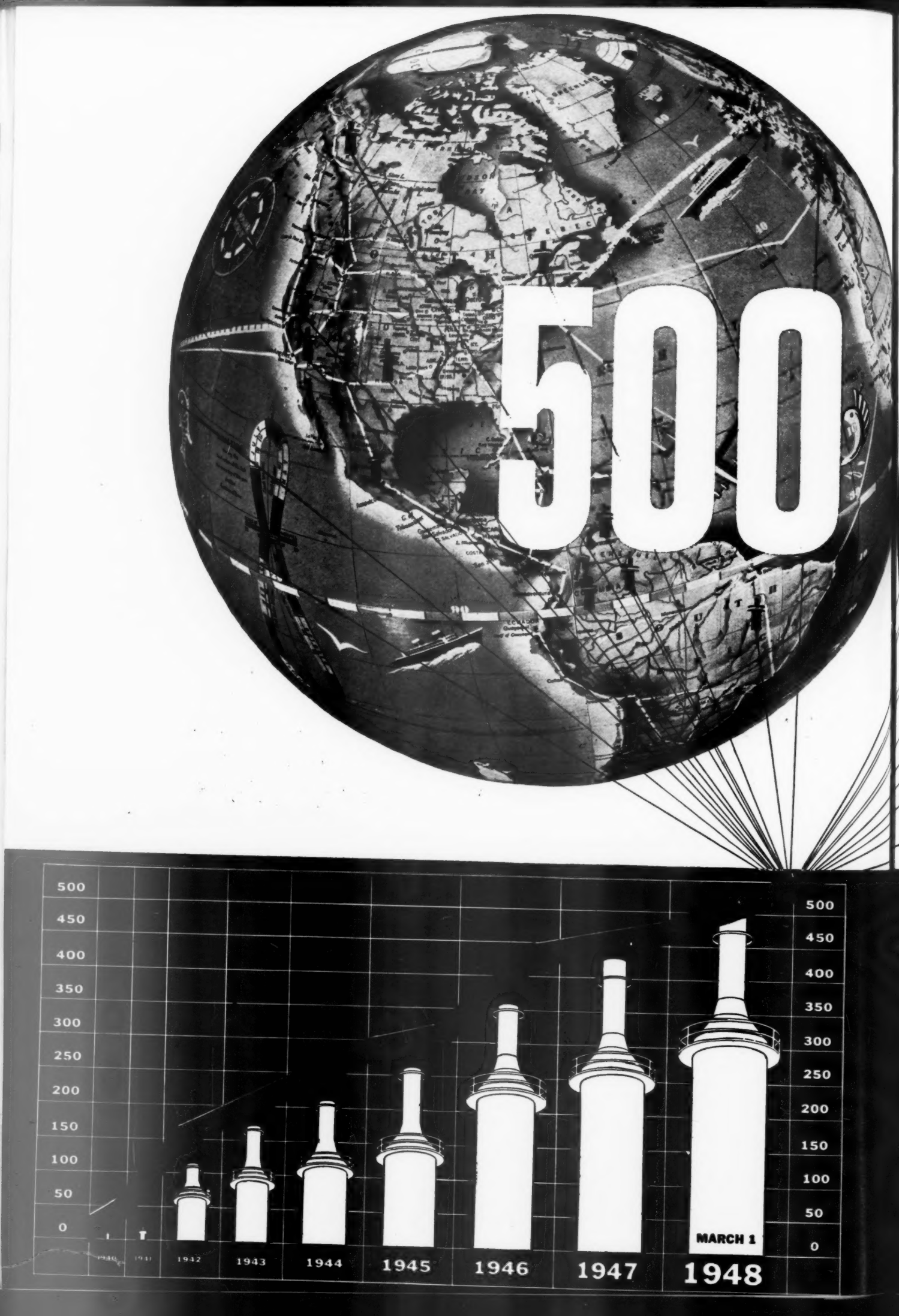
COMPLETING a construction program begun in the latter part of 1946, the Arkansas Fuel Oil Company recently placed in operation their new Panola gasoline plant. This addition to the facilities already present in this vast East Texas gas field provides another source of gas for the transmission systems of natural gas pipe lines.

The plant site of approximately 100 acres is on the Daniels lease in the Carthage field of Panola County, Texas. It is about eight miles southeast of the City of Carthage and some four miles west of U. S. Highway 59.

The engineering of this plant from start to finish was a company project. All plans, drawings, and specifications originated in the natural gasoline division and construction was carried on with the assistance of the service department and other divisions of the company.

Original plans called for the plant to provide for a processing capacity of 50,000,000 cu ft a day with a potential production of 65,000 gal of liquid products. Changes in design and field development, however, demanded that this capacity be raised to 100,000,000 cu ft a day.

At the present time gas from 28 wells, many of them dually completed, is being delivered through a 12-in. field pipe line gathering system of the Arkansas Louisiana Gas Company under 1050 psi pressure into the plant. Most of these wells produce from the Upper and Lower Pettit between 5700-6000 ft. This gas contains considerable water vapor. Hydrate formation at a high pressure is a special problem. Numerous heaters are required on field lines for heating the gas to a temperature above the hydrate formation point. High pressure separators and scrubbers trap incoming condensate for processing in a fractionating unit similar to that of refinery design. Several specification products such as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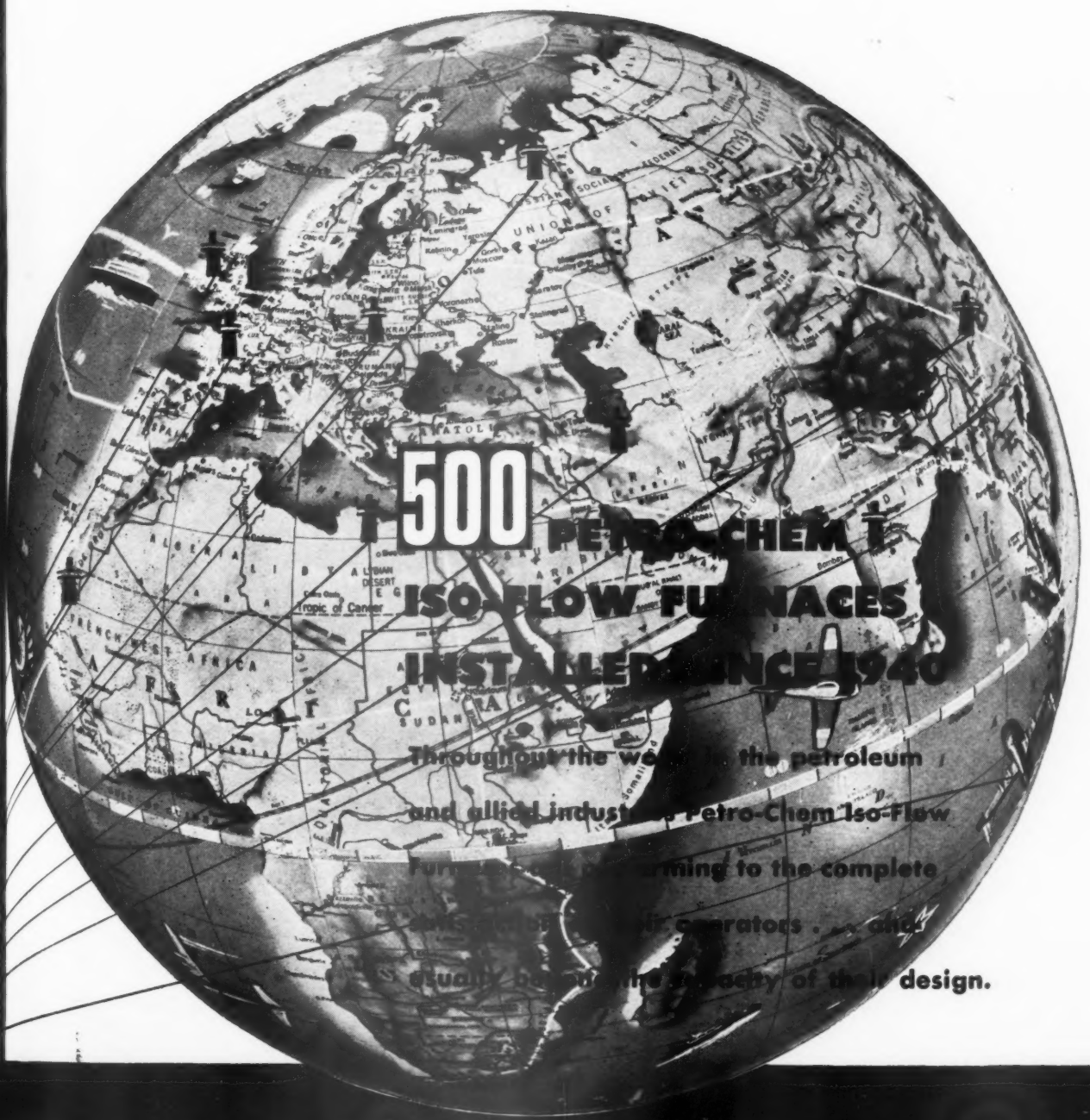

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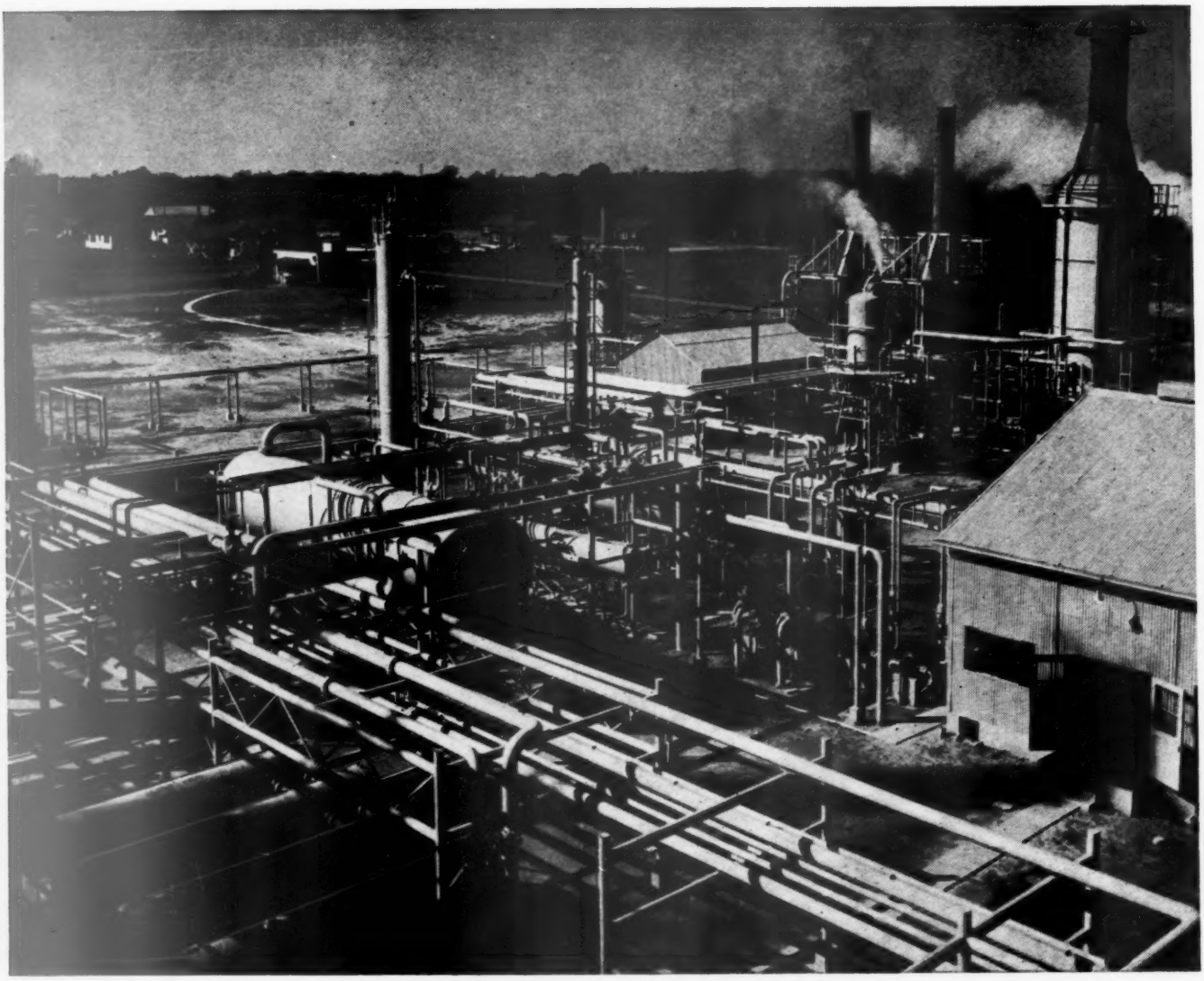

Part of plant processing area, above. Control board, below, for centralized instruments of all plant units.

absorption oil, kerosine, and diesel fuel are produced. Other plant equipment is available for the manufacture of various products such as motor gasoline, butane, propane, and other liquefied petroleum products.

● **Dehydration.** The plant operates on an inlet pressure of 1050 psi and the incoming wet gas first enters a 5½-ft by 80-ft absorber containing 30 trays. From the outlet of the absorber the gas is delivered into one of the plants two 4½-ft by 33-ft dehydrator towers, which are packed with activated bauxite desiccant. About 10 per cent of the inlet gas is diverted for use as a regenerating medium. This regenerating gas is passed through a heater and the temperature raised to about 400 F. It is there charged into the bottom of the off-stream dehydrator tower and passes upward through the desiccant beds to raise the temperature and release the absorbed water. This provides for one dehydrator tower to be in operation while the other is being regenerated.

The wet gas from the regenerating dehydrator is passed through two 58-tube atmospheric coolers having two passes and 303 sq ft of surface each. These cool-

THE on-stream records of the three Cities Service Fluid "Cats" illustrated here, prove the Kellogg thesis that the foundation for earning power in refining units is the engineering "know how" that is built into them. Conversely, the best designed unit in the world cannot attain its maximum earning power without the utmost care and efficiency on the part of the operators.

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ers are located in the first bay of the cooling tower basin.

The cooling tower is of the induced draft type having three cooling cells. Each cell has a 10-ft horizontal fan mounted at the top and driven by individual steam turbines. This redwood structure is approximately 40 ft high, 23 ft wide, and 120 ft long and has 20 cooling sections or bays.

The cooled gas next enters a 2-ft by 14-ft vertical scrubber where the condensed water is removed, and may then be delivered into the dehydrator stream or the pipe line direct, depending upon its dewpoint and the water vapor content of the main stream from the dehydrators.

● **Vapor recovery.** The rich oil trapped from the bottom of the absorber passes into a 6-ft by 40-ft horizontal flash tank upon which is mounted a high pressure reabsorber and the flashed vapors resulting from the pressure drop to 400 psi are stripped through this reabsorber tower and pass into the fuel or residue system. Condensate trapped in the plant inlet separators flows into a 4-ft by 22-ft horizontal surge tank operating at 400 psi and the vapors flashed here are charged into the high pressure reabsorber. Rich oil from the high pressure flash tank is accumulated in an 8-ft by 40-ft horizontal low pressure surge tank and traps into the bottom of a low pressure reabsorber. This reabsorber is a 42-in. by 35-ft column having 16 trays and operating at approximately 85 psi. This

PHOTOS BY J. E. HAMPSON

vessel also processed the vapors released when the condensate that has passed through the flash tank is trapped into a 36-in. by 20-ft surge tank operating at 100 psi. In this way a complete flash vapor recovery is maintained and the gas stripped thoroughly before passing into the plant fuel system.

● **Still and rectifier.** All enriched oil is then picked up from the bottom of the low pressure reabsorber by a turbine driven centrifugal pump and sent through a bank of four shell-and-tube exchangers, passing countercurrent with the lean oil from the still. From the exchangers the rich oil passes on to a direct fired heater and is raised in temperature to 600 F. Out of the heater, the oil enters a 36-in. by 10-ft disengaging drum and then flows into a system whereby it can be controlled through preheaters and reboilers on various columns such as the fractionator, stripper, and debutanizer for heat exchange instead of the conventional steam. After this extra service the oil is eventually passed into a 6-ft by 54-ft split flow still and rectifier having 20 trays and operating at approximately 100 psi. The overhead from this column is condensed through two shell-and-tube water-cooled condensers and accumulated in a horizontal reflux tank. A centrifugal pump refluxes the still and all wet overhead vapors still uncondensed enter a bank of two three-pass atmospheric condensers in the center bays of the cooling tower basin, and all net overhead vapors are condensed.

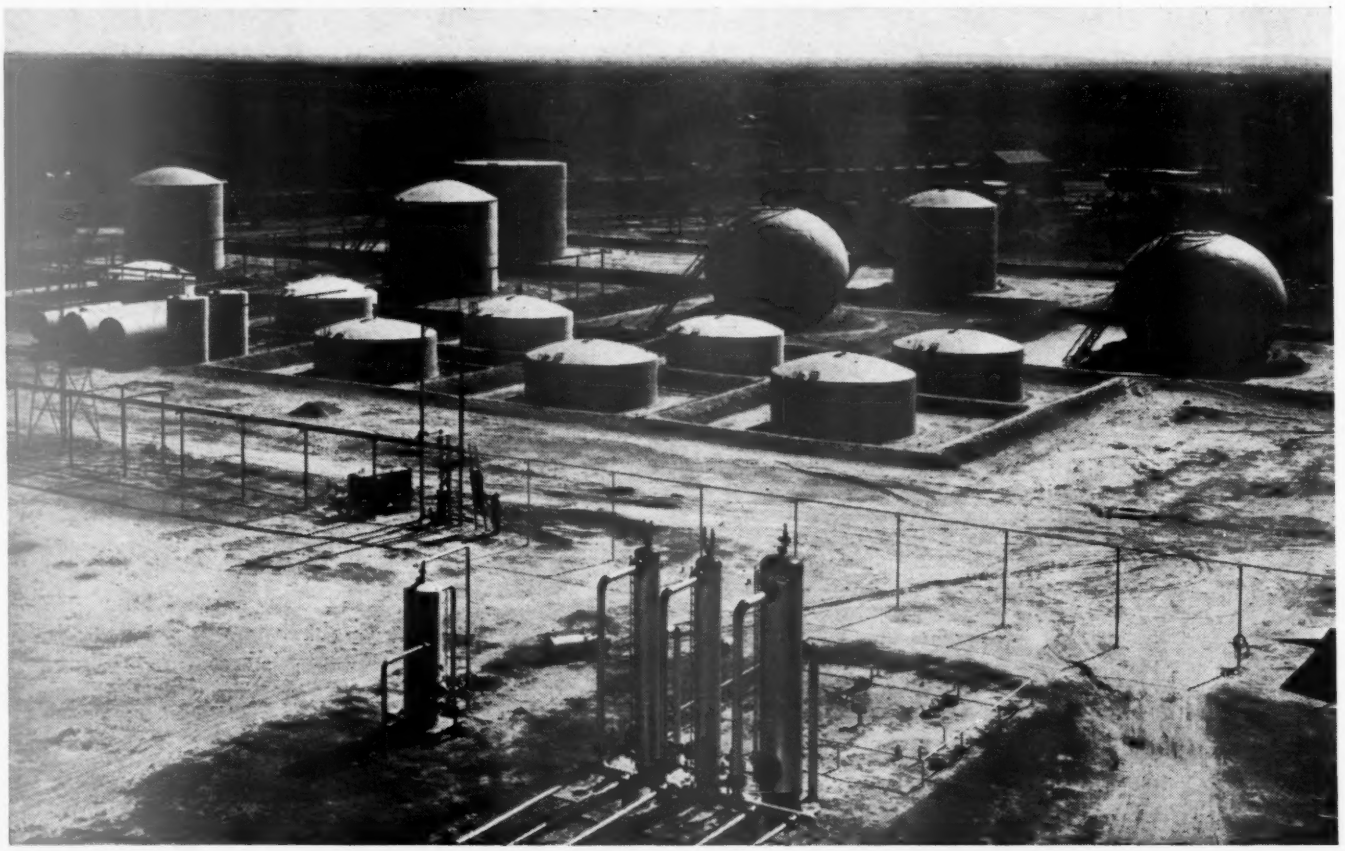
● **Contactor.** From here the condensed raw feed products pass into a 10-ft by 40-ft raw products surge tank on top of which is mounted a 24-in. by 20-ft contactor operating at 90 psi. Stabilized distillate is used as an absorbing medium in this contactor. Any purchased crude or condensate is also charged into this vessel and the overhead vapors pass back into the low pressure reabsorber.

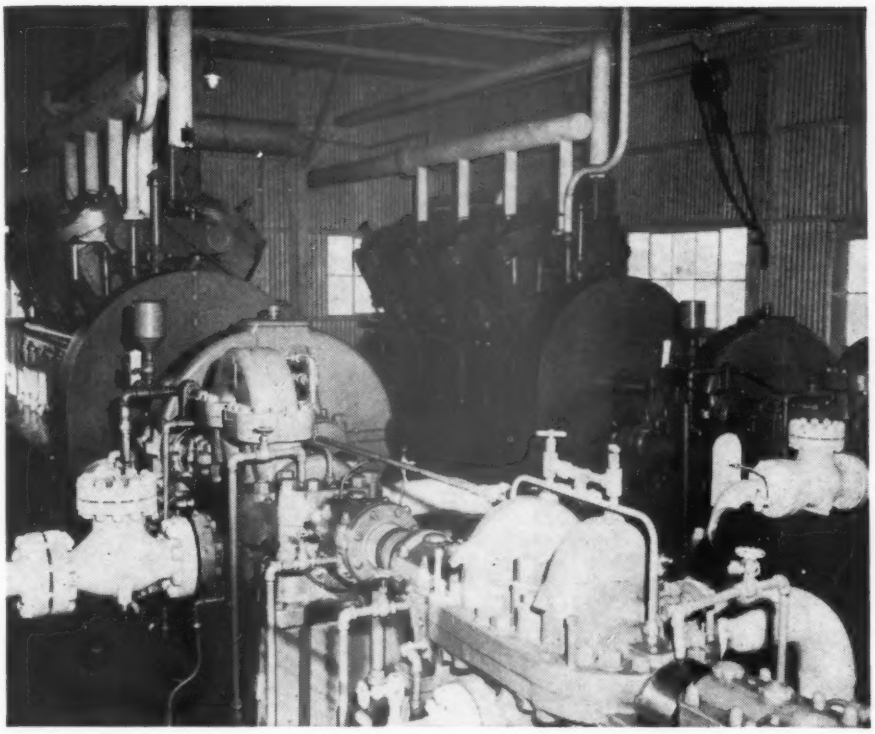
● **Debutanizer.** From the bottom of the contractor the oil is picked up by a close clearance reciprocating pump and charged into a 48-in. by 93-ft debutanizer column. This vessel has 48 trays and operates at about 260 psi. The charge is preheated through an oil-heated exchanger and enters the column near the middle tray section. Overhead vapors are condensed through a bank of two three-pass atmospheric coolers in the 14th and 15th bays of the cooling tower basin.

This condensed fluid is accumulated in a 6-ft by 20-ft horizontal accumulator tank where an 8 by 7 by 6 pump performs reflux service. Out of this tank, the charge for the depropanizer is picked up by a 6 by 5 by 12 pump.

● **Depropanizer.** The depropanizer charge is preheated by exchanging with hot bottoms and charged to a 48-in. by 83-ft depropanizer column having 40 trays. This column operates at 330 psig with a reboiler temperature of 245 F. Overhead vapors are condensed in an

Partial view of plant storage area. Horizontal tanks for liquefied petroleum gas products are not shown here. Plant inlet scrubbers are seen in the foreground.





Pump room showing multistage centrifugal pumps driven by 370-hp gas engines for lean oil circulation.

atmospheric section and the condensate is accumulated in a 4-ft by 20-ft horizontal reflux drum. Uncondensed vapors from this drum pass through a final atmospheric condenser and flow to a 48-in. by 20-ft deethanizer feed accumulator. This stock is fed to the deethanizer for removal of ethane to produce specification propane. The bottoms from the depropanizer reboiler pass through an atmospheric cooler to butane storage.

● **Fractionator.** The pentanes and heavier that are produced out of the 21-ft reboiler on the debutanizer are preheated through oil-heated exchanger and charged into the gasoline fractionator, which is a 6-ft by 73-ft vessel having 30 trays and operating at about 15 psi. Side cuts are taken here for kerosine and absorption oil.

All overhead from the fractionator is condensed through two shell-and-tube water-cooled condensers and collected in a 6-ft by 20-ft accumulator. Feed is taken from this tank by a centrifugal pump for refluxing the column.

A residuum recycle is maintained on the fractionater bottom by means of a 6 by 4 by 12 reciprocating pump, which circulates the bottoms from the column through an oil-heated exchanger. Excess is passed into an atmospheric cooler in the cooling tower basin and thence to storage as diesel fuel.

The side cuts of kerosine and absorption oil are processed in a 24-in. by 33-ft stripper column, which has the upper six trays separated for the kerosine section and the lower trays for finishing absorption oil. Vapors from the top of each section are returned to the fractionator.

From the absorption oil reboiler, the product goes to a four-pass atmospheric cooler and thence to storage. The kerosine production passes from its reboiler through an eight-pass atmospheric cooler and thence to storage. Both of these reboilers are equipped with flow control valves on the hot oil heating medium.

● **Deethanizer.** The charge to the deethanizer is preheated through a shell-and-tube exchanger and into the 36-in. by 65-ft column, which has 24 trays and operates at about 525 psi. Overhead vapors enter a three-pass condenser situated in the cooling tower basin and the fluid is accumulated in a 24-in. by 20-ft tank. Column reflux is maintained by a 5 by 5 by 12 pump. A reboiler on the column passes the butane-propane mixture into a eight-pass condenser and thence to storage.

Remote controls for the various units' automatic devices are housed in a corrugated iron building near the still and rectifier.

● **Water supply.** Water for the operation of the many condensers is supplied to the system from the cooling tower by means of a turbine-driven centrifugal pump. The plant water supply is presently produced from two deep wells on the plant yard. These wells are equipped with vertical turbines driving centrifugal deep-well pumps having a capacity of 150 gpm each. Discharge from the water wells flows through a hydrogen sodium zeolite treater and then through a decarbonator to storage.

● **Steam plant.** Plant steam supply is generated by two 336-hp water-tube boilers operating at 250 psi. These boilers have turbine-driven induced-draft fans. Water supply is maintained in a 1000-bbl wooden tank. An elevated deaerating feedwater heater is provided make-up by a 200 gpm centrifugal pump. The boilers are fed from this heater by a turbine-driven centrifugal pump. Air cooled exhaust steam condensers are also being installed to permit 90 per cent return of condensate.

A feature of the plant is the use of above ground and elevated piping in all units possible.

● **Blending plant.** The plant also has a tetraethyl lead blending plant of the tank car to 4250 gal weight-tank type. For this operation two 5000-bbl blending tanks with in-tank mixers have been erected. The unit is housed in a corrugated iron building 44 by 27 by 14 ft adjacent to the railroad spur track and approximately 100 ft from the tank car loading rack. An ASTM motor-method type CFR knock rating machine is situated in the laboratory for running control of product specifications.

● **Loading facilities.** A modern steel loading rack having spot connections for 10 tank cars, is situated near the east side of the plant on a spur track of the Gulf Coast, Colorado, and Santa Fe Railway, which runs adjacent to the plant. An adequate and convenient modern type tank-loading dock and platform is also installed for handling local movements of plant production.

● **Office and laboratory.** A five-room tile office and laboratory has been erected for the installation of the most modern testing and analyzing equipment, including one of the latest Podbielniak low temperature fractional gas analyzers. Large and roomy offices are available for the plant supervisory personnel and communication with main offices are provided by a private telephone line direct to Shreveport, Louisiana.

● **Storage.** Adequate and complete storage of plant production and blending stock is provided by a variety of vessels and tanks. Two 5000-bbl Hortonspheres are available for raw condensate stock. Motor fuel is blended and stored in two 5000-bbl vertical tanks. Four 1250-bbl vertical tanks are in a battery for naphtha and kerosine production. An 8-ft by 30-ft horizontal tank is used for naphtha rundown and a similar tank is provided for kerosine rundown. Two 10-ft by 40-ft horizontal tanks handle gasoline rundown and a 10-ft by 15-ft horizontal tank is used for diesel fuel storage. A 7-ft by 28-ft horizontal tank provides mineral seal storage.

Propane storage is provided by four 30,000-gal horizontal tanks, while butane production is stored in three 18,000-gal and three 30,000-gal horizontal tanks.

● **Conclusion.** The erection of this plant brings the Natural Gasoline Department total to 12 plants operating in Arkansas, Louisiana, and Texas. In view of field developments and increased exploration, it can be expected that the Panola plant will soon become the largest and most diversified of the Arkansas Fuel Oil Company plants.

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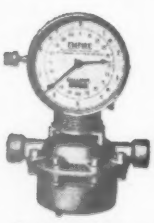

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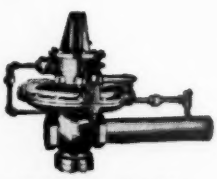

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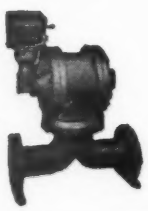
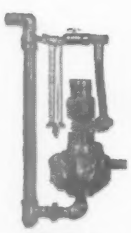


Rotocycle Pipe Line Meter



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Kimball Lake, Michigan, given a pipe line outlet

By G. F. WATSON, *Engineer*, Simrall Corporation

EXCLUSIVE

SIMRALL CORPORATION completed in December, 1947, a crude oil gathering pipe line between existing facilities at Reed City, Michigan, and the Kimball Lake oil field, Newaygo County, Michigan. Previously, the oil from this field had been transported by tank car and truck. Due to an active drilling campaign by the Sun Oil Company, discoverer and largest operator, production, although under state proration, increased to a point where these facilities were inadequate. The completed project gives the field a direct pipe line outlet to refineries in central and southeastern Michigan via Sohio and other transportation company pipe line systems. The gathering line also passes through two smaller fields, the Goodwell and Norwich pools of Newaygo County.

The Reed-City-Newaygo line consists of approximately 20 miles of 6-in. and 16 miles of 4-in. pipe, providing a maximum of 4500 bbl of oil per day.

The station at Newaygo has been in operation since March, loading tank cars and trucks, but was enlarged to handle more oil at higher pressures. Three units were installed, each consisting of one 3-in. 2-stage centrifugal pump directly connected to an 8-cylinder gas or gasoline engine in a series hookup, one unit being used as a spare. The two other units, when operating at a speed of 2200 rpm and against a pressure of 600 psi deliver 180 bbl of oil an hr into the Reed City storage tanks. No booster station is used at present.

A 5000-bbl stock tank was added at Reed City to take care of the increased gathering operation. The Reed City station pumps the oil to Simrall's Temple stock tanks, and at that point the oil is tendered to a common carrier pipe line. The 16 miles of 4-in. pipe runs northeast from the Newaygo station, and the 6-in. extends from the end of the 4-in. in the same direction for another 20 miles, connecting into the company's 4-in. Reed City loading rack line. Oil can be pumped from Newaygo to the Reed City station, or to the Reed City tank car loading rack. The Pure Oil Company line serving the Goodwell oil field was connected into the 4-in. section, 15 miles northeast of the Newaygo station. This involved very little work, as the lines crossed at this point. Oil is handled from this area on a joint gathering operation between Pure and Simrall.

Twenty miles of the Reed City-Temple gathering line had been looped in 1943 to handle flush production from the Reed City, Cedar, Evart, and Fork pools, but since then the quantity of oil from these fields has declined considerably and the looped line was unnecessary. Twenty miles of 6-in. pipe from this line was removed, hauled to Simrall's Evart, Michigan, warehouse and reconditioned. All joints were inspected for defects, the ends were cut off and the pipe beveled. This pipe is Grade B 17.02 electric weld. Most of the pipe appeared to be in good condition, but a few joints were discarded. The salvaging work was done by the Mahoney Contracting Company, of Mt. Pleasant, Michigan. The company also contracted the clearing, stringing, and laying of the Reed City-Newaygo line. The 4-in. pipe was Grade A, continuous weld, 10.79 lb per ft pipe. Six miles of this pipe was to be delivered monthly, beginning in late September, but due to the necessity of finishing the line before winter, some pipe had to be borrowed from other companies. For this reason, 10,000 ft of the 4-in. pipe is 8.75 lb per ft electric weld stock.

Most of the right-of-way crosses private property, but about 6 miles goes through the Manistee National Forest. A 24-ft width right-of-way was used everywhere, except through new plantings on government land, where United States forest regulations reduced it to 16 ft. Clearing began in mid-September. Sections of right-of-way through government land were bypassed until permission to enter them was granted. There are several streams and small swamps along the right-of-way, but none that required any special consideration in construction. The weather was dry and the water level low. Two bulldozers helped to clear the land.

The 6-in. reconditioned pipe was moved by truck from the Evart warehouse and strung along the right-of-way beginning from the Reed City junction end, an average round trip of 50 miles. The new 4-in. pipe was shipped by rail to White Cloud, Michigan, and hauled from there to the right-of-way by truck. White Cloud is about the mid-point on the 4-in. line. Four trucks were used to string the pipe. Bulldozers pulled trucks in some swampy sections. Some difficulty was encountered in stringing through the National Forest, for trails are few and narrow in these sections, with practically no graded or improved roads.

Two railroads and nine state road crossings were bored, the township and county roads being cut. All crossings were cased, the 4-in. by 6-in. pipe, and the 6-in. by either 8-in. or 10-in. pipe.

The contractor began laying pipe on October 17, and the laying, ditching, and backfilling had been completed by December 1. The weather was exceptionally favorable for this time of year in Michigan, except the last two weeks of November, when freezing weather and snow slowed up work. Four electric welding machines were used, one for running the stringer bead, and the others for bell-hole welding.

The two railroad crossings were made according to railroad regulations—casing pipe 4 ft 6 in. below rails, extending 45 ft from the nearest track, and vented with 2-in. pipe, Series 300 NRS. Gate valves were installed on both sides of each railroad crossing. Adding these gate valves is not a railroad requirement, but is company policy. A gate valve also connects the 6-in. and 4-in. pipe. The pipe goes under a high tension tower line at one place along the right-of-way. Here an underground cable had to be located before any work could be done in the vicinity. Numerous gas and oil lines were crossed. Where the right-of-way was reduced to 16 ft in the Manistee National Forest, some trouble occurred in getting welding machines, sidebooms, etc., through without damaging trees outside the 16-ft limit.

Ditching machines dug a trench 30 in. in depth. Two ditching machines and two sidebooms were used in the laying and ditching operations. The line was not ditched by machine through swamps, a total distance of about two miles; but in a few places it was ditched by hand upon request of property owners. Large rocks interfered with the ditching in a few places. Two angle blade bulldozers were used to clear, string, and backfill.

The brush was piled in the center of the right-of-way and burned. Stumps, of which there are many in this section, were pushed aside or removed.

The 6-in. pipe was tested with water under a pressure of 750 psi. Two breaks occurred simultaneously. One break had been caused by a weld checking, the other, evidently, by a rooter striking the pipe while being salvaged, which damage was missed by the inspector. The weather turned cold during the water testing, making conditions hazardous, for several short sections of line in swampy terrain had been left uncovered. After repairing the breaks, the company attempted no further testing with water. A compressor was procured and the 4-in. pipe, was tested with air by sections, 4 in all. An air pressure of 120 psi was applied to each section and held for 12 hr; then, when the pressure did not drop during this period, it was assumed that the pipe had no leaks. After filling the pipe with oil, linewalkers checked it for leaks but found none.

Oil had been pumped into the 6-in. pipe from the Reed City station, displacing the water used in testing. Simrall's maintenance crew enlarged the Newaygo station, set the pumping units, and tied the station into the 4-in. line. Oil began moving through the system during the first week of December, and has continued at 4200 bbl a day average with no difficulties to date. ★ ★ ★

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Portable equipment for shallow drilling*

By ALBERT LOGAN WAIT, JR., and JOHN W. HORNBROOK, Wait Manufacturing Company

● **Trailer-mounted unit.** It is the intent of the author of this paper and his business associate to explain and describe certain pieces of equipment that were built and designed for well drilling, both spudder and rotary types, utilizing to a degree orthodox and accepted methods for drilling as well as new and more efficient style and ways to perform a task.

Previous to June 1, 1946, the author and his associate, and a group of engineers started on paper the conception of a drilling rig that would have new features, and in the opinion of the author as well as his associates would tend to lessen the work of the usual operation requirements in drilling and completing either an oil well or a water well.

The first step was to decide what sort of conveyance should be used to move the equipment. It was decided that a four-wheel trailer, employing dual wheels all the way around with a removable dolly at the front or fifth wheel point, should be used. This was to be equipped with brakes and the trailer was to accommodate a load that would be greater than 25,000 lb. The idea of the trailer promoted the thought of extreme portability and ease of handling, and equipped with a removable dolly made it possible for the trailer to be pulled by a standard truck, or by removing the dolly it was possible to back a standard truck tractor under the front part of the trailer; thus, using the fifth wheel plate and pin. This arrangement had several advantages over the standard skid or truck unit, in that (1) the dolly could be used with a bolster when not used with a trailer or as a part of a trailer, and useful loads could be hauled on the dolly, such as, pipe, kellys, drill stems, and other equipment peculiar to rotary drilling operation. It is also possible to attach a tractor to the tongue of the trailer, and move in over a particularly rough terrain, or in extreme cases, attach a winch line to the tongue of the dolly and move the entire trailer to the desired location. The frame of the trailer is reinforced with additional welded construction to support the drawworks, which consists of double drum and spudder unit, an entire welded fabrication. The engine supports and mounting frames are of welded fabrication and mounted to a substructure, also welded. The pump, which is an Oil Well 7½ in. by 8 in. is mounted to an all-welded support frame and the derrick, a jackknife construction all-tubular and all-welded.

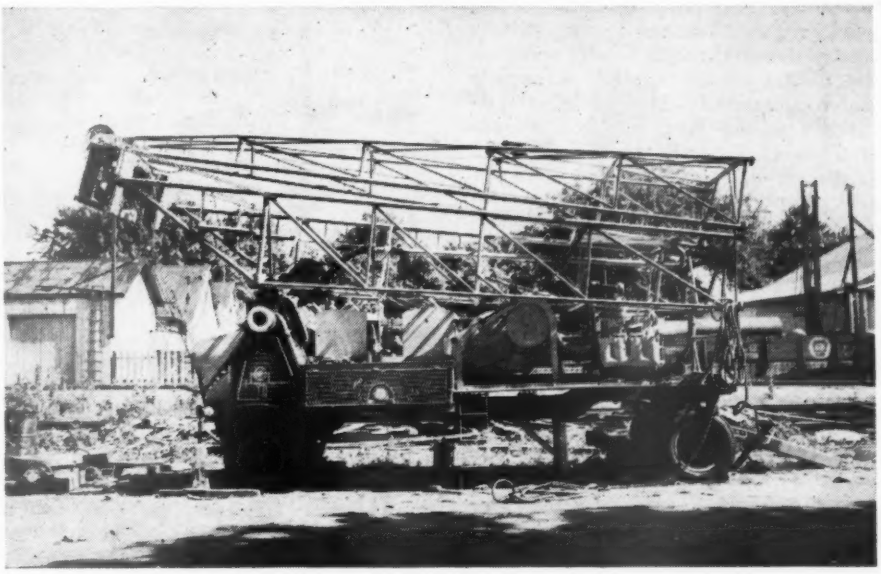
This unit was tested in November, 1946, and the tests were made in order to ascertain what changes would be necessary to make this unit function efficiently and properly. Upon completion of the tests, it was found that the only changes necessary were the heights and clearances of one guard, and the welding into place of an idler and idler supports to off-set excess lashing in a drive chain. These changes were made in the field with a portable welding machine, power driven, and with a 200-amp Lincoln welder mounted on a small two-wheel trailer, also of welded fabrication, towed by a passenger car to the location. Drilling capacity is 2000 ft. of 9-in. hole.

To describe this unit in detail will call for a bit of imagination by the reader, but let us assume we are looking at the back end of the trailer-mounted unit and we find the derrick, which has been raised by means of cables and pulleys, which are attached and are welded to the derrick and frame and which are an integral part of the unit. The height of the mast is 54 ft. in the clear and carries a three-sheave welded crown block assembly. Coming down the mast are clips, brackets, and light supports for night operation, which are welded securely to the tubular sections of the derrick. The stacking board that supports the drilling pipe is likewise of all-welded construction. The flanges at the hinge or breaking points of the derrick are welded to the frame on both sides, and are equipped with welded lead pins to insure safe and easy joining at the connection or joints.

The sub-support for the rotary table is an all-welded frame, fabricated from angle and I-beams. The guards, covers, and inspection frames are all of welded type construction from plate, expanded metal and angle. The drums and the drawworks are fabricated types made from plate steel and pipe and are mounted in an all-welded frame that supports the pillow blocks and bearings. At this point, may we say, that castings were used in three points only in the drawworks: (1) In the pillow blocks proper, which were made for us from our patterns of cast steel (not cast iron), and (2) the bronze bearings that govern the eccentric action of the spudder unit, which is housed in a welded circular frame. We wish to emphasize again that this unit carries only three type castings, the steel pillow blocks, the bronze bearings, and the cast-steel sheaves. Clutches and brakes on the drum are operated by controls that are of welded fabricated construction.

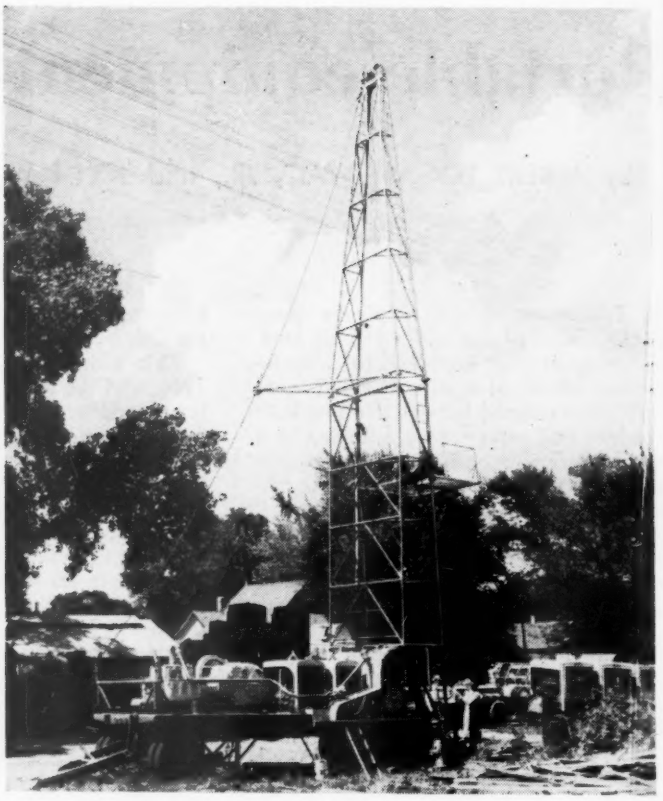
The spudder unit to which we have already referred is of welded construction and in the drilling of water wells as well as oil wells it is often necessary that

Trailer mounted unit for shallow oil exploration and water well drilling can be towed to location by a passenger car.



*Data and illustrations are from a study submitted to The James F. Lincoln Arc Welding Foundation, Cleveland, Ohio, in its $200,000 Design-for-Progress Award Program for reports on advancements and improvements made by the application of arc welding in design, fabrication, construction, and maintenance.

The trailer mounted unit in upright position ready for drilling. Capacity is 2000 ft of 9-in. hole.



The skid type unit shown below weighs approximately 10,000 lb and has a drilling capacity of some 1000 ft of 9-in. hole.

spudder type drilling be used to complete a well. It was with this thought in mind that this spudder attachment was fabricated to complete an operation of drilling with greater ease, and to utilize both the speed of rotary type operation and the desirability of spudder type drilling where necessity and judgment demanded.

The engines on this particular unit are 100-hp Mercury, and are so mounted that either engine can be used independently or the two compounded to drive the rotary table, either the upper or lower drums of the drawworks, the spudder unit, the cathead, and the pump. The frame or engine supports are of welded design and construction and so fabricated as to accommodate, with minor changes, any desired industrial engine for all practical purposes that the user would request. The two engines drive a master sheave through V-belts and from the master sheave a shaft through a clutch operated 7½-in. by 8-in. reciprocating type Oil Well Supply Company mud pump. The other end of the shaft drives through a four-speed transmission to operate the drawworks and the drilling end of the unit proper. This unit when completed weighed approximately 26,000 lb, and was designed to meet all road requirements, thus fitting itself for the completeness of handling and maneuverability.

☆ ☆ ☆

There are 16 oil fields in the United States that have produced to date more than 100,000 barrels of oil per acre. Santa Fe Springs, California, has produced 561,000 barrels per acre; Long Beach, California, has produced 479,000 barrels, and the East Texas field has produced 164,000 barrels per acre.—*The Petroleum Data Book*, Dallas, Texas.

Specification Data

Rotary table

12.9 to 1—Engine in highest ratio of transmission.
Example: Engine speed 2000 rpm.
Rotary table 155 rpm.

Pump

27.125 to 1
Example: Engine speed 2000 rpm.
Pump 74 spm, or,
290 gpm with 6-in. liners;
340 gpm with 6½-in. liners;
390 gpm with 7-in. liners;
450 gpm with 7½-in. liners.

Pump

290 gpm with 6-in. liners pumping clear water at 350 psi requires 69.0 hp.

Line Speeds

Lower drum

Ratio: 4.82 to 1
Example: Engine at 2000 rpm.
Drum at 435 rpm.
1087 line ft per min. on bare drum barrel.
2537 line ft per min. on full drum.

Top drum

Ratio: 7.68 to 1
Example: Engine at 2000 rpm.
Drum at 261 rpm.
653 line ft per min on bare drum barrel.
1522 line ft per min on full drum.

● **Skid type unit.** Our second unit was a skid type unit. This unit was of all-welded construction with these exceptions: The sheaves—cast steel; the pillow blocks—cast steel; the rest of the unit proper, which was built and fabricated in our shop, was all welded.

The mast, a telescoping type, two-leg tubular unit, is raised and lowered by sheaves, welded to the sides of the outer unit and cables attached to the inner section. At the base of the mast are two welded bearing points that enable the operator to raise and lower the mast with power supplied by the unit. This unit is a single drum type with drawworks of completely welded fabrication, including spooling drum as well as the brake drums. The drive chain to the jackshaft is attached to the welded frame supporting the drum. The rig floor is all-welded construction. The support for the rotary table is of all-welded construction. The engine frame support and mountings are welded and designed to accommodate a standard industrial engine and transmission; power transmission from engine to drawworks by means of V-belts. The second engine mounted on the welded skid type frame is coupled directly to a 4-in. centrifugal pump. This type unit weighs approximately 10,000 lb, and has a drilling capacity of approximately 1000 ft of 9-in. hole.

This unit was designed for portability and for low initial cost as well as low operating cost. The rig is designed to operate with V-belts or chain, and an auxiliary pump of positive displacement type, should requirements so demand this change, can be made by changing the coupling drive to a sheave or sprocket type and the addition of a reciprocating type pump. The catheads, side rollers, and the controls are of all-welded construction.

Standard clutches, standard bearings, and accessory parts were used throughout both the skid type and the trailer type units. Bolts, studs, and machining were held to a minimum and used only where inspection, replacement or adjustment and moving parts so required.

★ ★ ★

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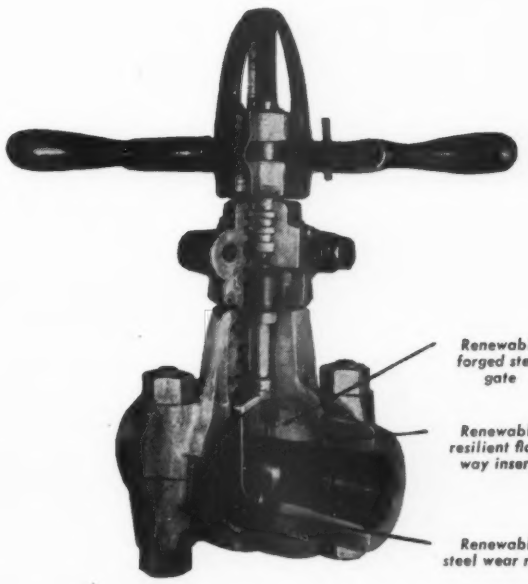

Contract demand an innovation in rate making

By M. C. MADSEN* and W. J. QUINLAN†

EXCLUSIVE

DURING 1947 Northern Natural Gas Company wrestled with the greatest operating problem in the history of the company, and curiously, it was all paper work and did not concern the pipe and compressors usually associated with the ordinary natural gas pipe line operating problem.

The overwhelming demand for natural gas and the associated shortage of materials for necessary expansion of pipe lines are common knowledge and need be expanded upon only briefly.

With the staggering postwar demand for natural gas exceeding expectations and with Northern's limited ability to procure the necessary facilities for expansion, the company in December of 1946 requested the 31 utilities serving 202 communities in its market area to discontinue until further notice the connection of new space heating customers. It was determined at this time by various studies that if a day equal to the coldest day on record occurred during the 1946-47 winter season, the firm requirements with all interruptibles curtailed would exceed pipe line capacity. This resulted in a supplement to the gas schedules containing emergency rules and regulations for possible curtailment of firm gas deliveries, applicable to the 1946-47 heating season.

After the experience of the 1946-47 heating season, although all firm demands were met, it was all too evident that a tighter rein was necessary to more adequately protect Northern's present customers from the galloping demand, which was threatening to outrun system capacity.

After considerable study exploring all the possibilities, a contract-demand type rate was installed, effective with the billing month of November, 1947. The new rate developed in collaboration with the staff of the Federal Power Commission was designed to accomplish two major purposes. It placed a limitation on the firm and interruptible load growth to protect the requirements of presently connected consumers, and it reduced the rates.

The new rate is an innovation in that it limits to the contract-demand volumes Northern's obligation to sell and deliver gas. At the time the rate was installed, the daily pipe line sales capacity was 317,000,000 cu ft. This sales capacity was allocated so that each of the communities served received a certain portion of this volume. This is known as the "contract demand" and was based on the firm demand in each of the communities on the system firm peak day last winter, December 30, 1946. The contract demand is the amount of gas that Northern is obligated to deliver, and is also the basis for the demand charge that the utilities pay to Northern for reserving this volume of gas for their communities.

The new rate calls for a demand charge for each 1000 cu ft of billing demand for each billing month. During the off peak months of April through October, the billing demand is 80 per cent of the contract demand. For the months of November through March, the billing demand is the maximum volume of gas delivered on any day of such month up to the contract demand, but not less than 80 per cent of the contract demand. There is also a commodity charge for each 1000 cu ft of gas delivered.

On most days the towns without interruptible customers are unable to use their contract demand allocation because of relatively warm weather compared to a day with a temperature of around zero, and a lower firm demand results on their local distribution systems. Gas that is not used in one community is then available for use elsewhere. This gas is then allocated by Northern to other communities that have interruptible customers and a demand above their allocated contract-demand volume, and is known as over-run gas. As the temperature plummets and firm gas requirements increase, the amount of available over-run gas decreases and curtailment is ordered into effect.

For a temporary transition period curtailment of interruptible customers has been set up in five different steps, according to their size. Curtailment by the pipe line dispatcher is ordered within these steps to reduce takes only as low as the contract demand, except during periods of equipment failure. After the five steps have been orderd in effect and further curtailment is necessary, then step six is ordered, which is contract demand. For curtailment operating purposes, six zones have been set up (see map). Curtailment within these zones hinges on adequacy of pipe line pressure and anticipated weather conditions within the zone.

Step six does not go into effect until Northern notifies the utilities that their receipt of gas is limited to the contract demand. After due notification, any gas used over the contract demand is considered unauthorized over-run volume and is subject to a penalty of $10 for each over-run 1000 cu ft. This is over and above the regular rates and is stiff enough so that in general it becomes prohibitive for the utilities to use unauthorized over-run volumes. The penalty charge has been intentionally set high so that one community will not exceed its contract demand and possibly deprive another community of its contracted share of gas. The money collected from these penalties is held in escrow by Northern, and in November of each year is distributed among the utilities.

If on a cold day when contract demand has been ordered into effect a utility uses less than its contract demand in one community, such "underage" may be used to offset the use of over-run gas in another community without penalty,

TABLE 1

Northern Natural Gas Company pipe line additions during 1947 to increase system capacity from 325,000,000 to 390,000,000 cu ft per day.

OD, in.		Main lines, miles	Main loop lines, miles	Branch lines, miles	Gathering lines, miles	Total miles
16	Sunray, Texas (to Texas main line)	37.31				
20	Palmyra, north (Nebraska)		21.01			
18	Fremont, south (Nebraska)		6.02			
18	South Sioux City, south (Nebraska)		34.39			
20	Nicollet Avenue extension (Minnesota)			1.76		
12¾	St. Paul tie-over (Minnesota)			1.89		
6⅝	Fremont-Schuyler (Nebraska)			28.02		
6⅝	West St. Paul (Minnesota)			.70		
6⅝	Worthington (Minnesota)			11.10		
4½	Jefferson (Iowa)			4.32		
20	Hugoton (Kansas)				11.22	
20	Sunray, Texas (to Sunray station)				3.11	
16	Hugoton (Kansas)				5.13	
12¾	Hugoton (Kansas)				4.62	
6⅝	Texas (gathering)				5.95	
4½	Texas (gathering)				2.37	
6⅝	Kansas (gathering)				4.42	
4½	Kansas (gathering)				15.14	
	Total	37.31	61.42	47.79	51.96	198.48

*Chief engineer, Northern Natural Gas Company.

†Editor, *Northern Natural News.*

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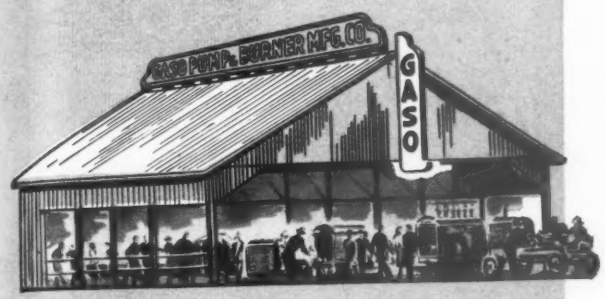

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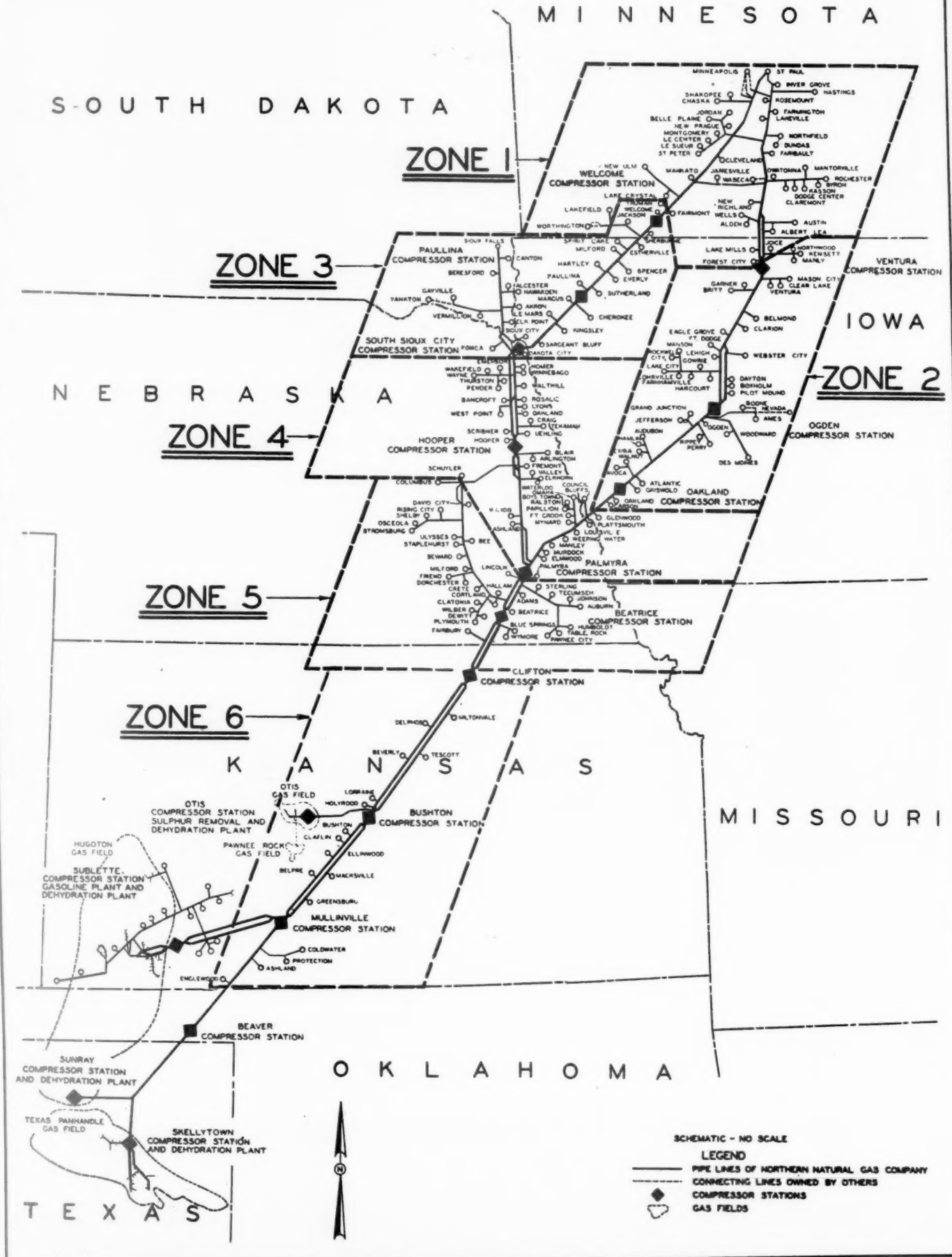
System map of Northern Natural Gas Company showing curtailment zones of dispatching department.



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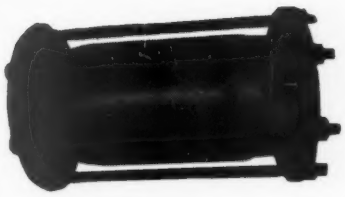

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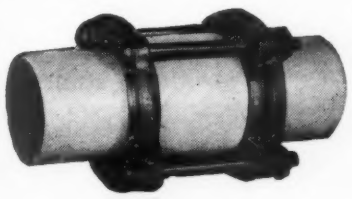

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provided the underage actually contributes to meet the overage in the other community and such overage does not adversely affect Northern's ability to deliver gas up to the contract demand of all utilities.

The rate also stipulates that Northern will not authorize any additional large volume commercial and industrial consumers to be connected until present contract demands are increased. When able to increase pipe line capacity and hence contract demands, interruptibles will be added on a priority basis as set forth in the new rate schedules.

To aid Northern in planning future construction programs, the new rate states that the gas utilities will advise the pipe line company of any increases in contract demand desired for their communities for the following year. The following December, Northern advises the utilities of the amount of such capacity that is estimated can be reasonably provided. If the total requests of all the gas utilities for increased contract demands exceed the pipe line capacity or the gas supply Northern considers can be made available, the additional capacity is apportioned on an equitable basis.

In this connection an accelerated construction program was completed by the first of this year and provided 65,000,000 cu ft additional daily capacity. The salable portion of this has been allocated under contract demand to the various utilities.

The gas utility has the right to decrease the contract demand for any community in any year if Northern is able to utilize this released capacity.

The new rate effects a complete change in marketing policy for Northern. Under the previous rates, gas was sold to the utilities under several charges depending upon the service and size of the consumer. Now it is sold under a single rate for all gas delivered, based upon available capacity contracted for by each utility. The advantages of the new rate appear to be many. It provides a definite capacity allocation for future firm gas requirements of each of the gas utilities and in turn provides Northern the necessary information to increase its system capacity in a predetermined manner to the benefit of the ultimate consumer, the utilities, and Northern. The addition of new large volume interruptible type loads are controlled so that they do not come on to the detriment of interruptibles already being served. The small domestic users are more adequately protected against service interruption during severe weather.

The rate was not only designed for the present emergency, but has a long range aspect that should face squarely the overwhelming demand.

Our brief experience with the rate warrants only a general statement as to its effectiveness, but thus far it seems probable that it may accomplish everything for which it was designed.

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TABLE 2

Horsepower installed before 1947 and horsepower added during 1947 at compressor stations to increase capacity of Northern Natural Gas Company system from 325,000,000 to 390,000,000 cu ft per day.

Location of compressing stations	Horsepower installed before 1947	Horsepower added during 1947	Total horsepower 12/31/47
Welcome, Minnesota (new station)	..	3,200	3,200
Paullina, Iowa	2,400	1,600	4,000
South Sioux City, Nebraska	3,400	1,700	5,100
Hooper, Nebraska	3,400	1,700	5,100
Ventura, Iowa	2,550	..	2,550
Ogden, Iowa	3,400	..	3,400
Oakland, Iowa	4,750	..	4,750
Palmyra, Nebraska	5,600	2,800	8,400
Beatrice, Nebraska	7,000	7,000	14,000
Clifton, Kansas	11,000	5,500	16,500
Bushton, Kansas	9,800	4,200	14,000
Otis, Kansas	500	..	500
Mullinville, Kansas	9,910	..	9,910
Sublette, Kansas	7,700	2,200	9,900
Beaver, Oklahoma	5,600	1,400	7,000
Sunray, Texas (new station)	..	1,100	1,100
Skellytown, Texas	6,600	..	6,600
Total	83,610	32,400	116,010

Note: Horsepower ratings shown are latest revised ratings of engine manufacturers.

☆ ☆ ☆

Sun Shipbuilding and Drydock Company, Philadelphia, has tanker orders amounting to $50,000,000, the largest in peacetime history. Socony-Vacuum Oil Company ordered seven and Gulf Oil and Standard Oil (New Jersey) each two.

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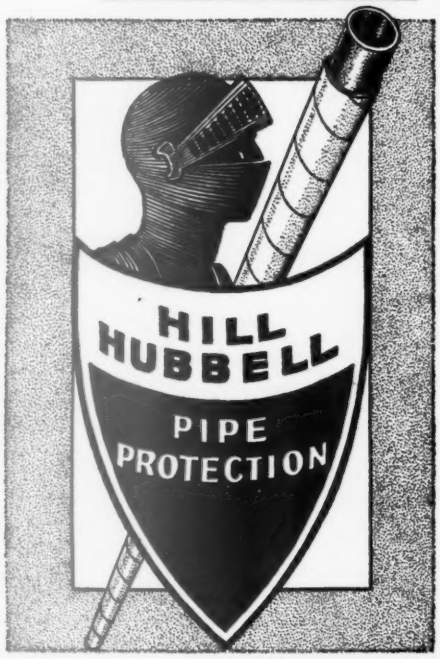

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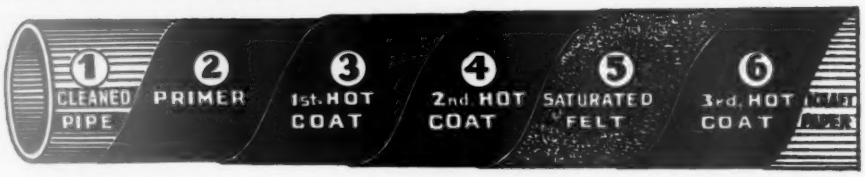

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"Thanks for a very satisfactory job"

"Accept our extreme appreciation for the hearty cooperation your crews extended"

"I commend your erection crews for their ability, cooperation and general helpfulness"

AMBASSADORS

"...we are reminded of the American 'tank gang' who were in our midst for so many months and who left last week for Saigon. These 'tank gangers' have done something; they have perhaps done more to establish good-will in the Far East than all other American contacts, diplomatic or commercial. They have, in truth, proved themselves worthy ambassadors of the great nation to which they belong". J. E. K.

Above comment entitled "Ambassadors" appeared in the South China Morning Post, November 16, 1947, after the HAMMOND IRON WORKS crew left for Saigon.

"Yours is a very efficient organization"

"We look forward to using your crews on future projects"

"We must congratulate you on the efficiency and cooperative spirit of your crews"

CUSTOMER SATISFACTION—THEIR POLICY

HAMMOND tank builders are Ambassadors of Good Will and service is their motto. Their every act, on and off the job, is guided by the spirit of helpfulness and customer satisfaction. Throughout the world they have left the impress of this spirit . . . in Hong Kong, Florida, Venezuela, Labrador, Panama, Texas, Shanghai, New York and wherever storage tanks are erected by Hammond.

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HAMMOND crews are constructing and rehabilitating storage tanks throughout the U.S.A. and many foreign countries.

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The row of gleaming metal cylinders actually represents a battery of ultra modern, automatic furnaces in Gulf's micro laboratory.

Doll house laboratory speeds oil research

How progress toward meeting history's greatest demand for oil is being aided by the micro-laboratory—where scientists work with "doll-sized" instruments in a world of the infinitely small—is revealed by Gulf Oil Corporation.

Nothing less than a chemical workshop in miniature, the petroleum micro (meaning small-scale) laboratory is successfully speeding up one phase of human activity usually impossible to hurry, namely, scientific research.

Its results are achieved by working with quantities of material ten to hundreds-of-thousands of times smaller than used in ordinary research. These smaller samples, manipulated by Lilliputian instruments designed for the job, can be analyzed with far greater rapidity than normal amounts.

Conservation of expensive and scarce chemical materials (some of which may have taken months to distill in minute quantities); saving of two-thirds in sorely needed laboratory space; and ability to study substances so small as to otherwise defy analysis, represent other micro-lab advantages.

As a unique safety feature, highly explosive materials may be experimented with on such a reduced scale that serious explosion dangers are eliminated.

Equipment used in this advanced field of industrial research would delight the heart of any small girl engaged in doll-house-keeping. A tiny feather fastened to the end of a glass rod serves as a brush. Glass capillaries, or tubing that is thinner than a match stick, replace standard test tubes.

Tiny "boats," the size of a girl's little fingernail, transport materials. These materials in turn are shoveled or handled by scoops, knives, and pincers scaled proportionately.

A glass encased balance, fundamental instrument of micro-chemistry, provides a weighing scale so sensitive that it accurately measures weights less than one ten-millionth of an ounce.

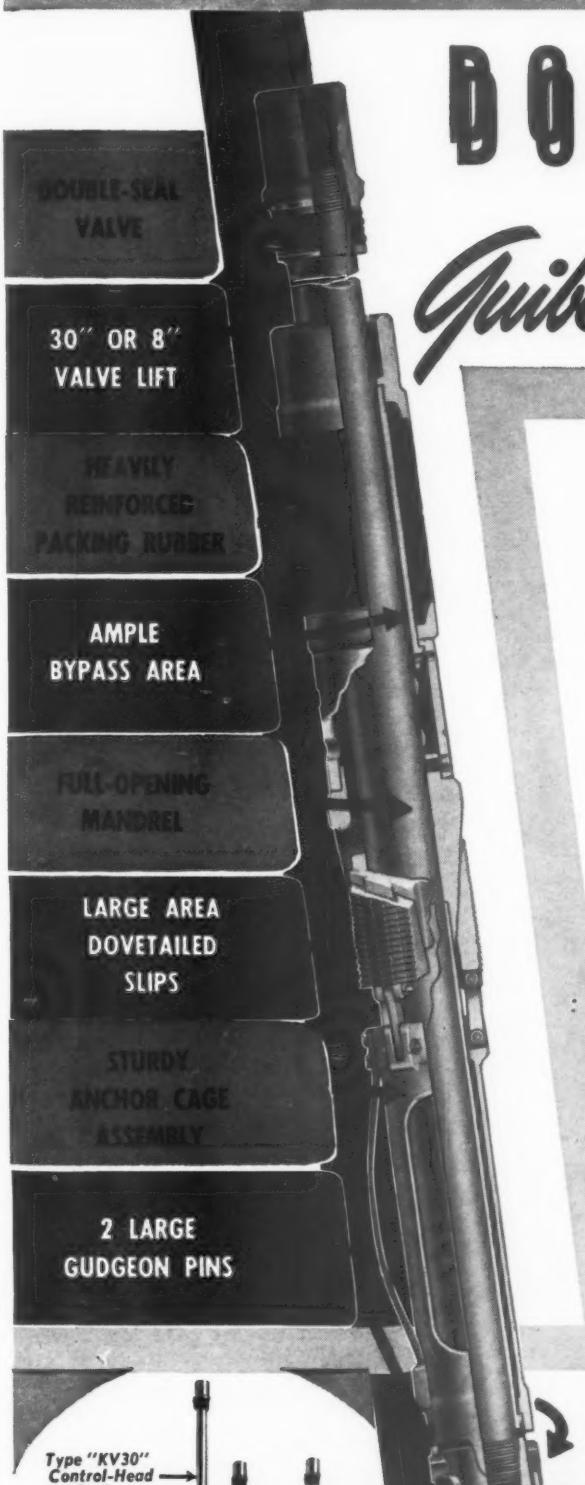
A micro-manipulator, a fabulous machine for handling instruments too small to be accurately directed by the human hand, enables the scientist to work in a drop of water under a microscope as if he were utilizing materials in beaker and test tube. Within the drop, he can move particles too small for the human eye to distinguish by means of the manipulator's almost infinitesimal probes, rakes, hoes, and shovels.

Quantities of solutions dealt with are sometimes so small that they must be

Instead of a brush, a feather on a glass rod sweeps a few grains of sample (here a petroleum inhibitor) into a combustion boat. Visible at extreme left are "pigs," in which chemicals are safeguarded against absorbing moisture from the atmosphere. That coiled wire in the center is gold (used in mercury determinations) while the metal fixed in a glass handle is platinum.

DOUBLE-SEALED

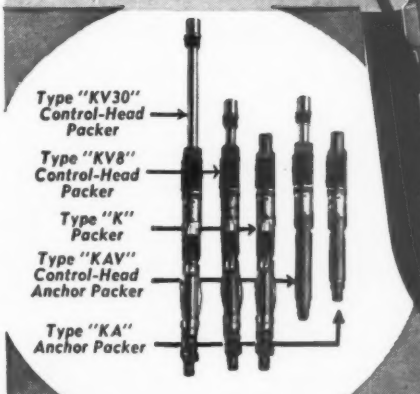
PROTECTION WITH *Guiberson* TYPE "KV" PACKERS



Built for trouble-free performance in deep wells where high pressures and high temperatures are encountered. Guiberson's Type "KV" Packers have double-sealed protection at the valve—the regular tapered metal valve and seat plus a special multi-ring resilient sealing sleeve. The pack-off rubber is oil-resistant, has reinforced ends, and will not vulcanize to the casing. Dovetailed slips are extra large, heat-treated. Heavy seamless mandrel has full opening —internal diameter is same as tubing string. Ample bypass area permits faster running and pulling in heavy fluid. Valve is locked in open position by rugged gudgeon assembly to prevent closing when running in the hole.

Guiberson "KV" Packers pull with ease. The 30" valve lift on the "KV30" permits a long stroke to dislodge the slips and packing rubber. Type "KV" packers will pull loose easily even with a high head of fluid above the packer, due to the small valve diameter.

Guiberson Type "KV" Packers are ruggedly built of durable materials to give you positive pack-off under the most difficult well conditions. Available in 4¾" to 7⅝" casing sizes. See the Composite Catalog, pages **1508-11,** for the complete series of "K" Packers in Hook-wall or Anchor types with or without valve.


Type "KV30" Control-Head Packer
Type "KV8" Control-Head Packer
Type "K" Packer
Type "KAV" Control-Head Anchor Packer
Type "KA" Anchor Packer

THANK SORRY SAFE BETTER BE GUIBERSON (REG. U. S. PAT. OFF.)

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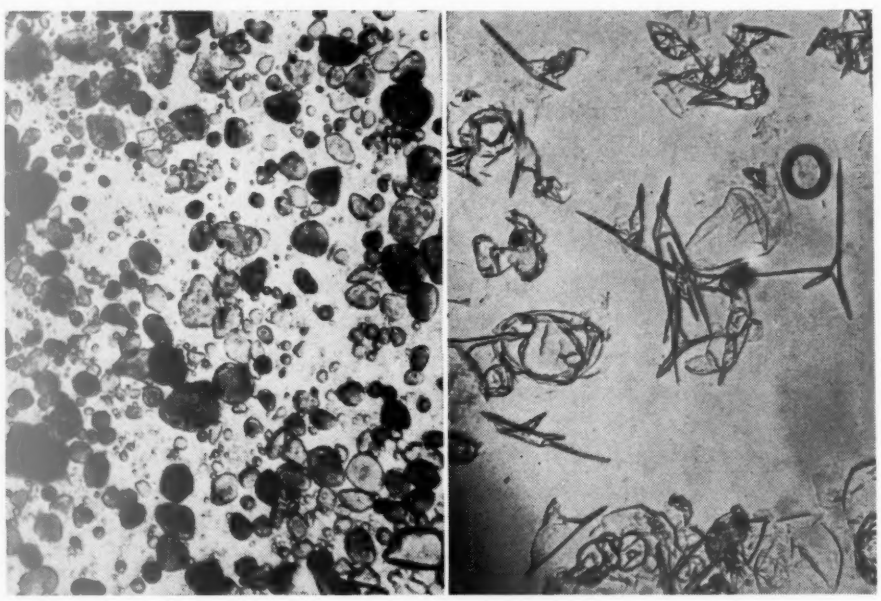
"Spot tests" permit immediate identification of many complex materials, and are so accurate they can detect the brass on a man's hand after he has touched a brass doorknob. Paul Ross, Gulf micro-chemist, shows how a sample of deposit is scraped from a lacquered piston for study with the portable kit.

Whoosh—a micro explosion jars the test tube! Photo shows micro-lab's advantages in working with highly explosive materials, which can create real danger in ordinary laboratory quantities. Robert E. Snyder, micro-chemist, wears protective mask during the analysis of the unknown material.



Not a bed of gravel at left but a photomicrograph of how a typical catalyst—the material that makes possible most modern gasoline refining—looks through the microscope lens. Right, jagged particles are actually part of a commercial wax. Microscopic study of the forms of such materials often enables micro-scientists to identify unknown particles by their structures.

kept in transparent, humidified cells, because exposure to air would cause instant evaporation of the entire sample.

These instruments, and the technique developed by petroleum and other scientists, enable the detection of quantities too small for human perception. By analyzing the scrapings from a man's hand, the laboratory can determine whether the hand has recently touched a brass door-knob. By examination of a silver coin, micro-scientists know whether it has been rubbed against a nickel in a change pocket. By comparison of thread particles, they can distinguish between wool and felt.

Gulf's micro-lab at nearby Harmarville, thought to be the pioneer of its type in the petroleum industry, is making valuable contributions to the research progress, on which greater petroleum production and improved petroleum products depend.

Mico-lab "spot tests," to determine the nature of a material from a crystal or drop of its solution, allow immediate identification of many complex mixtures, without resorting to the usual methods of separation and isolation.

A portable "spot test" laboratory has been developed that can be carried in a suitcase size container. By its means, analyses may be made anywhere in the field, saving weeks or months in the gathering and back and forth transport of materials.

Determination of carbon, hydrogen, and oxygen, more used in organic analysis than any other test, has been tripled in speed by miniature combustion units that the micro-lab has helped perfect. These automatic, electrical furnaces move at varying rates along combustion tubes and may be set for desired cycles, leaving research workers free for other tasks.

Similar combustion techniques have been developed for automatic nitrogen, sulphur, and hologen determinations.

Microscopic work is being successfully applied to regulating the size of catalysts—key material in modern refining — through use of microscope grid screens. So called dark field microscopy, where objects are studied by refracted light, has notably successful results in application of the material (silicones) used in non-foaming oil.

Analysis by polarograph (an instrument using the principles of electrolysis) is applied to dilute solutions containing tiny percentages of materials for "trace" analysis. This eliminates or shortens lengthy separation of elements. Actual analyses can be run in 10 minutes in place of perhaps six hours required in orthodox procedure.

Scores of such micro-lab developments are bringing closer tomorrow's solutions to the problem of more and better petroleum products for an oil-hungry world. ★★★

Further report on the rivet plate

By J. A. CAMPBELL, Research and Development Engineer

EXCLUSIVE

ABOUT seven years ago, in an article written exclusively for *The Petroleum Engineer*,* I described the development and commercial tryouts of the rivet plate. At that time there was some skepticism on the part of technical men regarding the life of these rivets in service. Everyone who saw the operation of the glass model embodying the rivet plate was sold on its performance. The froth beds were perfect, consisting of a mass of very fine bubbles. The overflow pans were 7 in. above the plate and when the gas was shut off this 7-in. froth bed settled to 3 in. of "solid" oil with no "weeping" whatever; yet, when the gas lock was broken below the bottom plate, the oil readily flowed back through the jets with a heavy downpour at each rivet hole.

Recently, due to increasing pressure drop through two 7-ft absorbers at one of California's largest absorption plants, it was decided to shut the absorbers down one at a time and clean them. These absorbers were equipped with the rivet plates in 1938 and had never been shut down for cleaning since being installed. In fact, the plant had been so overloaded that they had not even been back-washed. More absorbers were installed and the top head was unbolted from one of these and the 16 plates were unpacked and removed.

The gas into this plant carries a considerable amount of CO_2, and the downtubes, which were of light iron, were in bad shape. Holes were eaten through some of them. This, of course, is bad, for it permits the gas to pass up through the downspouts, which keeps the oil from coming down. The defective downtubes were replaced, and the plates were washed with a hot water jet and wire brushed, then inspected.

The amazing thing was that the die-cast rivets were in perfect condition. There was no evidence of wear whatsoever. After nine years of operation 24 hr a day, 365 days a year, passing 7,000,000 cu ft of gas per day at 40 psi pressure, not the slightest wear could be detected. Yet, is this so surprising after all? If you are mathematically inclined do a little figuring. You will find that in all these nine years, during which time 22,995,000,000 cu ft of gas passed through the absorber, less than 1,000,000 cu ft passed through each jet. You see, there are 7000 rivets on each plate, and four jets to each rivet, making 28,000 individual jets on each plate.

After nine years of operation there was an average of about 12 rivets missing from the total of 7000 on each plate. This is insignificant, for the holes are only 5/16 in. in diam and will pass only a fraction of the gas passed by one slot of the conventional bubble cap.

During all this period, which is longer than the life of many gasoline plants, these absorbers maintained top extraction efficiency up until a few months ago when they began to show excessive pressure drop. The second absorber was in just as good condition as the first. In this same plant there is an 18-plate evaporator equipped with rivet plates handling 500 gal of 350-deg oil per min. This evaporator has run continuously for nine years at top efficiency and has not shown any tendency toward clogging. The rivets safely will withstand temperatures up to 500 F. They are die-cast under 1400 psi pressure from a special alloy that has a tensile strength greater than bronze.

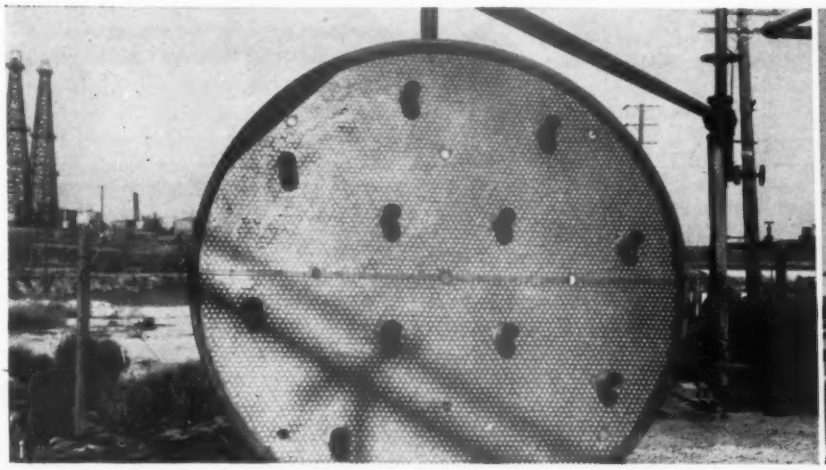
I have always been a champion of the perforated plate. I think it has many advantages over the bubble cap. It is not recommended for fractionators handling crude oil or any substances of a gummy nature, however.

When, more than 30 years ago, I was engaged in some of the first development work on the absorption process, we were using a well designed type of bubble cap. Being of an inquisitive mind, I quite often operated the absorber on my pilot plant with the top head off to observe the action. I was not satisfied with it. The bubbles coming through the oil bed were too large. Even in those early days, we knew that the absorption "act" occurred when a molecule of gasoline vapor came in contact with a film of oil. It seemed logical to me that within these large bubbles there must be many molecules of gasoline vapor that were not in contact with the enveloping film of oil.

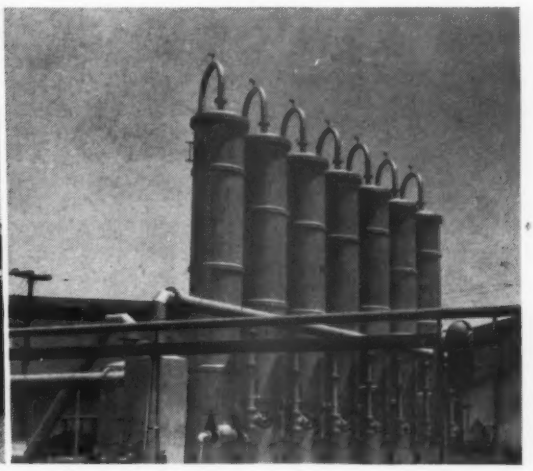
We were, at this time, carrying a depth of oil of 6 in. on the plate. Our bubble caps were 2 in. high. I conceived the idea that a fly screen above the bubble caps would break up these bubbles. To check the theory I cut out a piece of flyscreen to fit inside a large glass cylinder and cut a hole in its center to ad-

*"A Practical Discussion of the Mechanics of Oil Absorption," by J. A. Campbell, *The Petroleum Engineer*, May, 1941.

Rivet plate for a 7-ft absorber showing top of rivets and 12 overflows. The holes are for 1-in. pipe supports.



Battery of seven 450-lb absorbers with bolted heads.



mit a length of rubber tubing. I forced this down in the cylinder to within 2 in. of the bottom and poured only 6 in. of absorption oil into the cylinder. I connected the rubber tubing to a source of gas and turned some through. The bubbles were definitely broken up by the screen but quickly reformed above it. I next tried two screens, then four, then six, spaced ¼ in. apart. A very fine froth bed was formed. I built screen nests, one for each tray, of my pilot plant absorber, and put it in operation. The extraction efficiency increased 20 per cent.

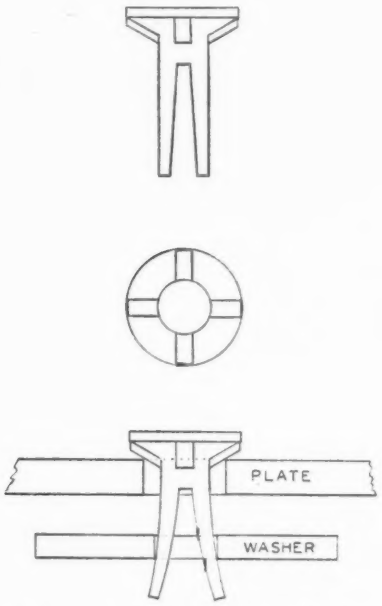
The first plant I built used this type of tray with the screen nests above the bubble caps. Shortly afterward I adopted the perforated plate because it was much simpler and it seemed much more logical to have the gas in small jets and have it traverse the full depth of oil on the plate rather than have a large proportion of the oil cross the plate below the ports of the bubble caps and thus not come in contact with the oil at all. This channeling seemed very undesirable.

A few years later when I began my own research and development work in conjunction with the business of building absorption plants, I began working with glass models. I had, as a background, years of experimental and research work in determining the proper number of trays, the best depth of oil to use, the maximum free shell velocity, the most desirable oil-gas ratio, and the upper limits of saturation. I had also done some exhaustive work on maze travel across the plate, and proved it very undesirable. I definitely determined the advantages of multiple overflow. Absorption is instantaneous when the vapor comes in contact with the film of oil, and equilibrium is quickly reached. Running the oil in a long path and shooting it with fresh gas time and again, after it has become loaded, produces agitation that tends to drive out the lighter fractions. Through the partial pressure effect heavier fractions go with them.

As soon as the oil becomes enriched, it should be admitted to the next tray below where it contacts richer gas and can take on additional content.

Glass models proved to be extremely informative. From their operation I learned the proper size of perforations to use and the best spacing and pattern to adopt. I soon learned that the perforated plate was not very flexible. If one drops to about one-half the gas capacity of the absorber he encounters serious "weeping," that is, oil will drop through the perforations and if the gas rate is still further decreased all the oil will drop through the perforations and it will be impossible to maintain the proper depth of oil on the tray. There is a definite limit to the size of orifice that can be used. From my observations of the models I decided that smaller jets gave better frothing action, but there is a low limit on the size of jets because of danger of plugging.

After years of research and experimenting, the rivet plate proved to be



Details of conical-headed rivet.

the answer. The hole in which the rivet head rests is 5/16 in. in diam. The rivet head is ⅜ in. The rivet head is conical on its lower surface, and the conical surface carries four ribs as elements, 1/32 in. wide and 1/32 in. high. These four ribs keep the rivet from seating in the hole and form four jets 1/32 in. wide and approximately ¼ in. long. The jets are directed outwardly at an angle with the horizontal of 30 deg. There is a definite object in this design. Each surrounding rivet is just 1 in. away and when the gas starts through the jets of any rivet the resistance is decreased above all the six surrounding rivets and they come into action. Then the action progresses over the entire plate. Gas passing through any rivet hole decreases the resistance above all the surrounding units and permits them to cut in. You are certain to get action all over the plate.

Suppose you had a large hall completely filled with men to knock the hats off of the six men nearest to them. It's a cinch that no hats would be left on. Suppose, though, that your men were seated at large round tables or large rectangular tables. That is the difference between a perforated plate and a bubble cap plate.

Glass models of bubble cap plates show a distinct channeling. The gas, instead of passing through the entire depth of oil as it has to with a perforated plate, leaves the cap 2 or 3 in. above the plate; consequently, 2 or 3 in. of the total depth of the oil flowing across the plate is not contacted by the gas. If dark blue oil-soluble mineral dye is ejected into the oil this channeling can be observed readily.

There is also bad channeling of the gas at reduced rates. A single bubble cap has tremendous capacity. The ports are so large that there is no jet effect, and the gas comes out in very large bubbles that push the oil aside and create a path of much less resistance than it would find in trying to break through the "solid" oil above the inactive caps. All the gas will flow through one or two caps until the flow increases to a point where the flow resistance is greater through the open path than it is through the inoperative caps. Then another cap or two will break into action. In order to keep all the caps in action it is necessary to pass large quantities of gas through the column.

A bubble plate absorber will show almost no pressure drop across the entire column if run dry. A rivet absorber shows about 1 psi drop or about 1 oz across each plate. It is this back-pressure, even though very small, together with the slanted jets, that insures uniform distribution and eliminates channeling.

Flow across the plate is bad for two reasons. First, there is the gradient. We must have gradient or we have no flow, but concentrating all the flow between two points, especially at high oil rates, produces such a high gradient that much more gas will pass through the bubble caps near the overflow. Second, this cross-flow produces too much agitation, which we have determined to be objectionable. Multiple overflows, by creating shorter paths and much smaller individual flows, minimize the effect of gradient to insignificance. By using this expedient we are putting into practice one of the basic principles of experimental engineering, and that is this:

When in a development you are confronted with a factor that is working against you and you can't eliminate it, take steps to minimize its effect. It can't be eliminated, but it can be minimized almost to the point of elimination by the steps we have described.

The multiple overflows discharge the oil uniformly over a cone and angularly against the rivet plate. Here the oil is caught by the jets, frothed and lifted to the surface where it goes into the overflow. The flow is not across the plate, but is vertical along with the gas, a sort of gas lift. This creates less agitation and a finer froth because the bubbles are not "sloshed" together to form bigger bubbles. The fine froth bed acts as a screen and tends to break up large

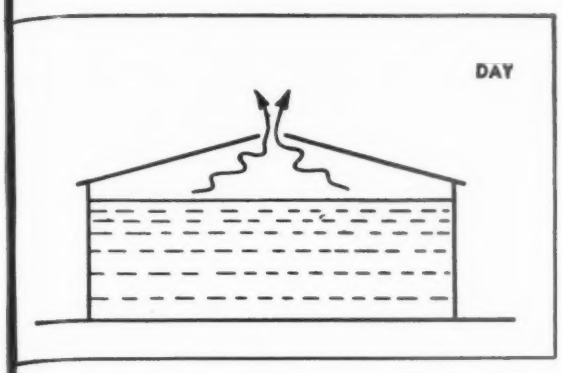
Two foreign discoveries

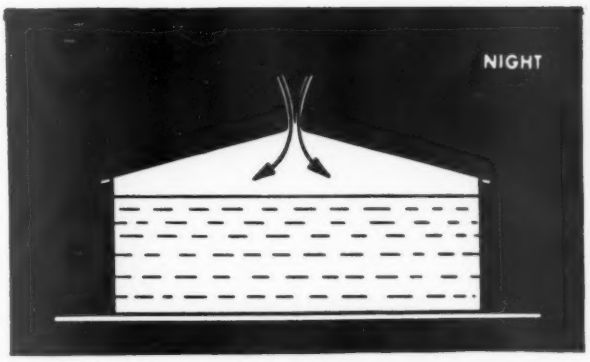
A new oil field in Egypt and another one in Venezuela were reported last month. Both were found by affiliates of U. S. companies.

The Egyptian field is said to be 10 miles south of the Sudr field, in the Sinair Peninsula. It was discovered by Anglo-Egyptian Oilfields, Ltd., owned 50-50 by Shell Union Oil Company and Socony-Vacuum Oil Company.

The Venezuelan discovery, made by Creole Petroleum Corporation, a Standard affiliate, is said to be from deep formations in the Maria district of Zulia State.

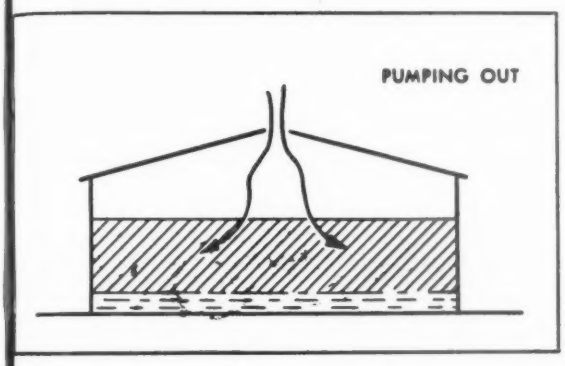
STANDING LOSSES

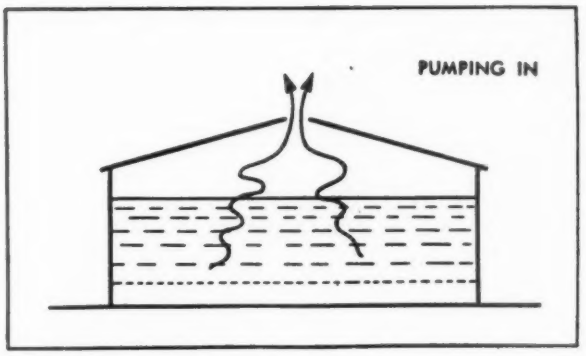




Standing losses vary from 2 to 4 percent of the tank volume per year, depending on the tank size. In addition, the value of the gasoline is reduced through vapor venting.

PUMPING LOSSES





Pumping losses may be conservatively estimated at 0.16 percent of the liquid volume pumped.

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The Wiggins Hidek Floating Roof

Hermetically seals the liquid surface.

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bubbles into small bubbles. Small bubbles bursting at the surface do so with much less explosive force than large bubbles, and consequently do not throw mist or large drops of oil high above the plate. Sixteen inches is ample spacing for the rivet plates, but even with 20 in. in the bubble cap plates with single overflow, serious carryover at high rates will be observed.

Bubble caps, under certain conditions, will "pump" and "bounce." This is due to the pneumatic effect of alternate compression and decompression of the gas under the caps. With heavy cross flow on the plate between discharge and overflow you will get what is called "hydraulic jump." This makes a profile of the surface of the oil take on an effect similar to a sign curve and forms thin troughs of least resistance where most of the gas will tend to flow.

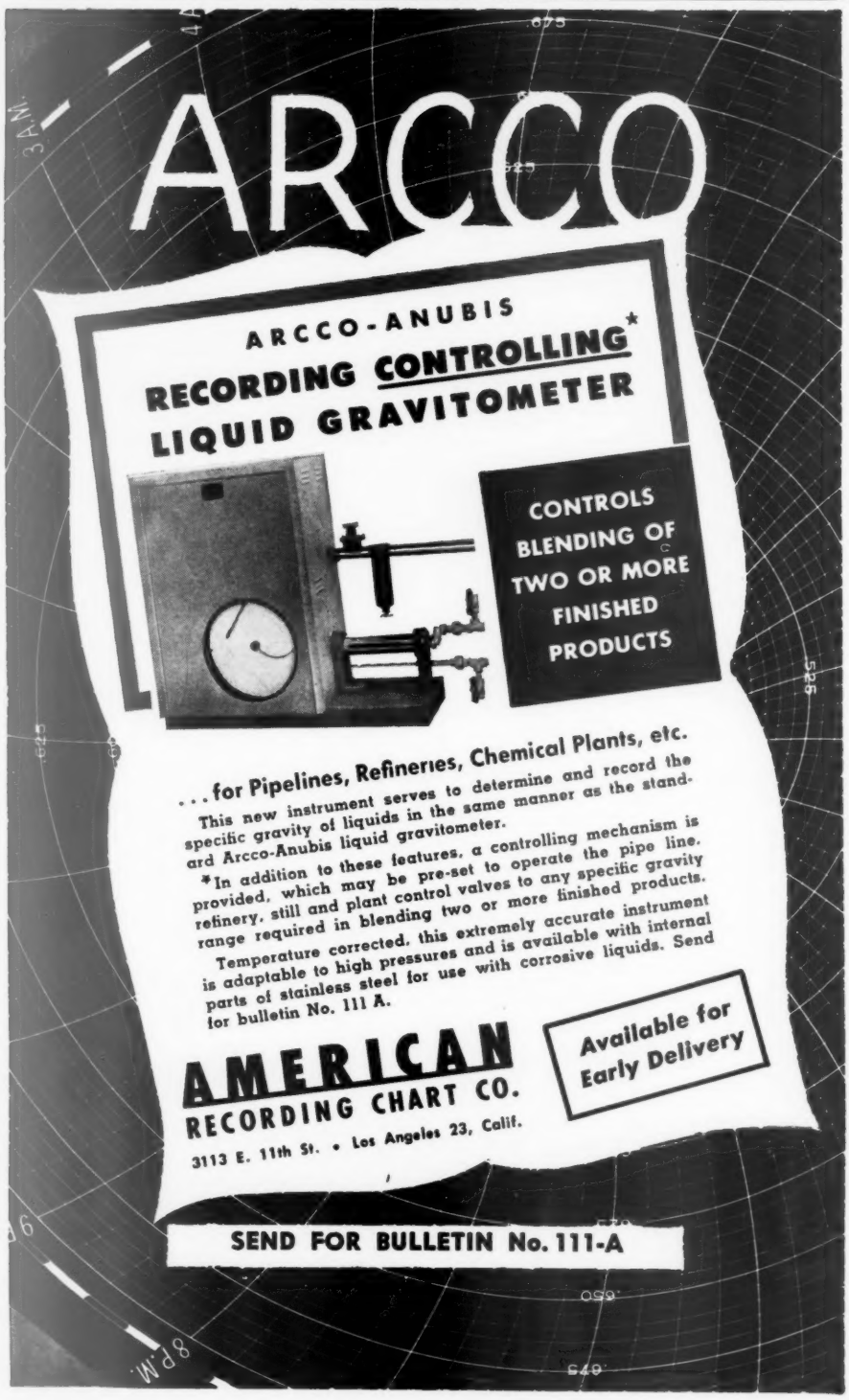
All these effects are eliminated by the rivet plate with multiple overflow. The surface tension of the kerosine distillate absorbent is sufficient to bridge the 1/32-in. by ¼-in. jets although it will not bridge a ⅛-in. round hole. The oil with no gas at all going through the column will remain up to the level of the overflow, assuring maximum efficiency at all rates from maximum down to zero.

A glass model that contains three plates, the middle plate being rivet type, and the other two perforated, demonstrates clearly that the method of shooting the jets out at an angle produces a much finer froth because the jets shoot into each other and break up into fine bubbles on first contacting the oil. The most violent action is directly after the gas leaves the jet near the bottom of the oil pool. The action is then much quieter as the bubbles rise through the oil bed lifting the oil with them to the overflow pans. The entire plate is filled with rivets. The only "dead" area is that occupied by the down tubes, and these extend up to the overflow pans and the oil is all around them. There actually is no dead area at all as there is in the bubble cap design.

It is difficult for me to understand the trend in the industry today to seal a column up like a thermos bottle filler. It costs so little more to put on a flanged and bolted head. You can today get steel alloy bolts heat treated with a tensile strength of 200,000 psi and gasket material is a lot better than it was 30 years ago. Of all the hundreds of absorbers, evaporators, fractionators, and stabilizers I have ever built I have never welded on a top head. Some of these have operated at 600 psi pressure and we had no gasket leaks. It makes no difference how good an oil cleaning plant you have in conjunction with your absorption plant for reconditioning your absorption oil, if you do not have highly efficient scrubbers protecting your system from the rotary mud and finely divided formation material that is constantly coming in with the gas, you most certainly will get an accumulation of extraneous material in your absorber. If your absorbers are equipped with perforated plates or rivet plates, you can wash and backflow every three months and keep your equipment fairly clean. If you have bubble caps you can't do this because there is no way of draining the plates. Chemical cleaning is ineffective. Few plants except those in the declining fields are equipped with spare absorbers so that they can back-flow. It is embarrassing and dangerous to have to get into your equipment with a welding torch.

It is well to have a look at the inside of your columns every three of four years, and if dirt is getting into them you will save a lot of production if you will take off the top head and remove all the trays and clean and inspect the entire assembly. This is a relatively simple matter if you have a bolted head and removable packed plates.

The difference in extraction between a dirty and a clean absorber may run as much as one-tenth of a gallon per 1000 cu ft, which on an absorber handling 8,000,000 cu ft per day would amount to a loss in one year's time of 292,000 gal. If your decrease is only 0.01 gallon per 1000 cu ft you are losing 29,200 gal a year and even that isn't hay. The absorbers are the heart of the absorption plant. It pays to keep them working at top efficiency. ★★★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LIQUID GRAVITOMETER
CONTROLS BLENDING OF TWO OR MORE FINISHED PRODUCTS
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This new instrument serves to determine and record the specific gravity of liquids in the same manner as the standard Arcco-Anubis liquid gravitometer.
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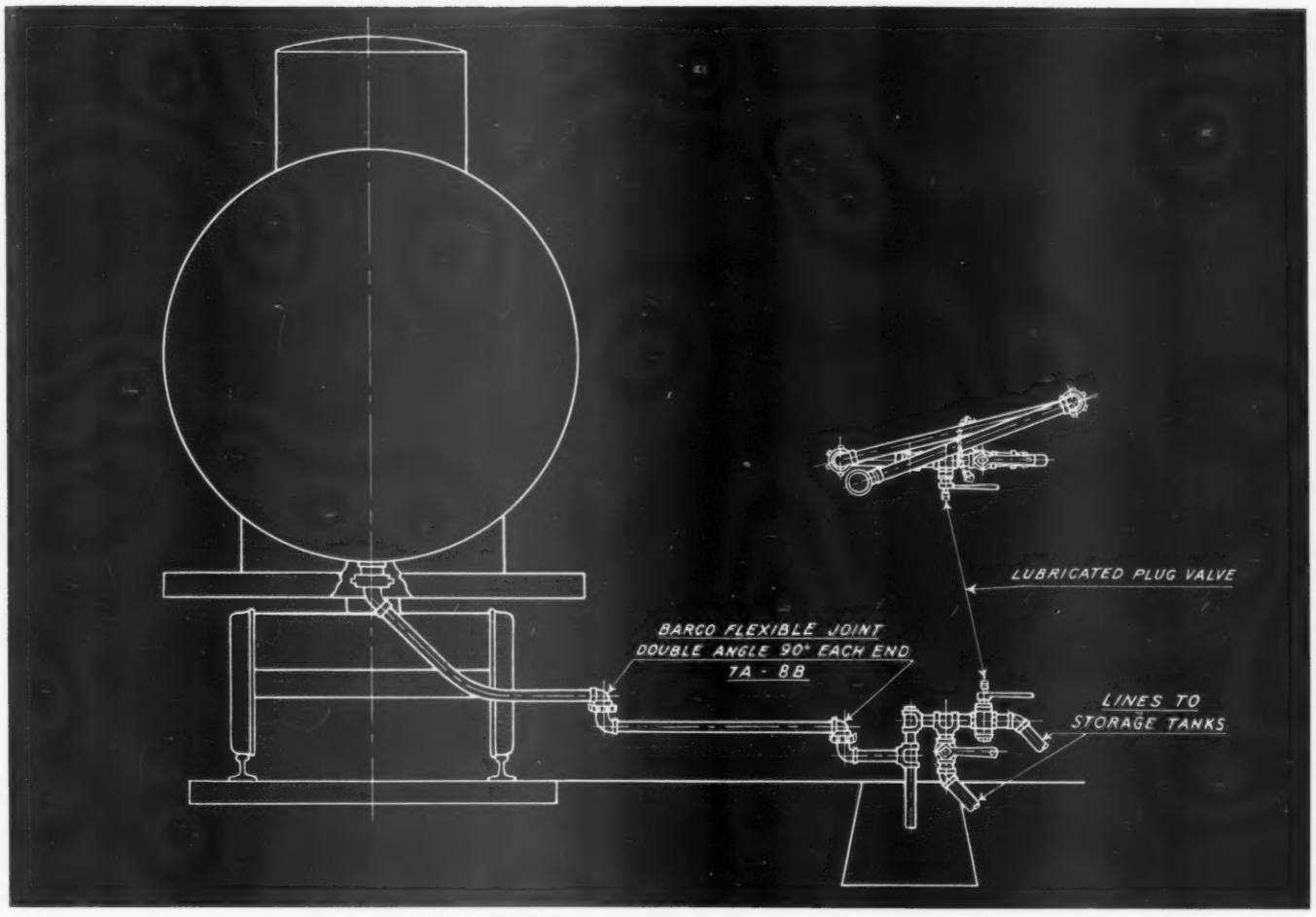


"Oil and Acid Discharge is Smoother" with BARCO *Flexible Joints*

The two Barco joints in this oil discharging connection guard against leaks and fire hazard. They permit loading lines to be made strong enough to withstand shock and compensate for expansion. For over 30 years engineers in every field of industry and transportation have picked Barco Joints to keep breaks and leakages at a minimum. Today, Barco's range of design provides for every flexible joint problem. Write Barco Manufacturing Company, 1825 Winnemac Avenue, Chicago 40, Illinois.

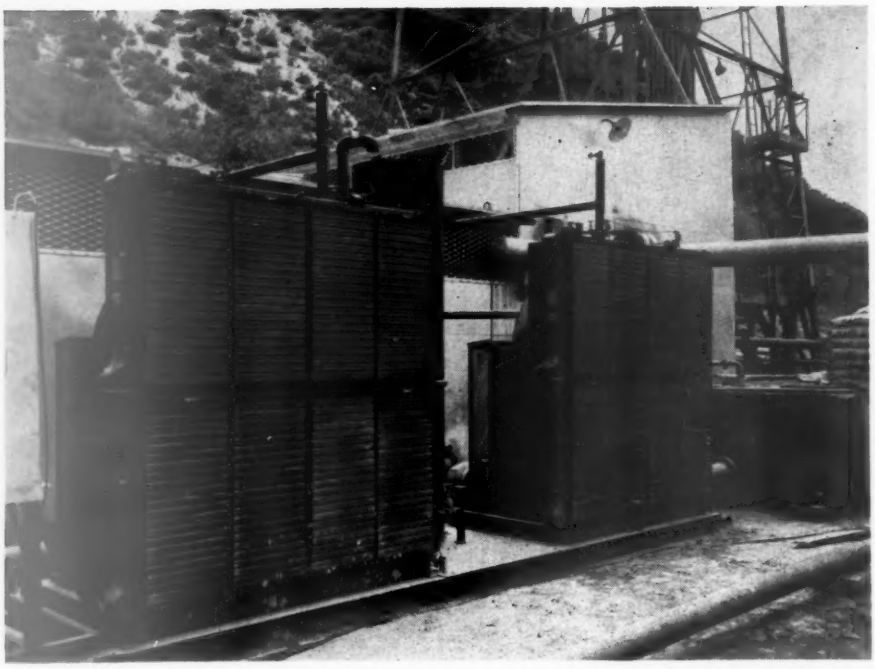
BARCO FLEXIBLE JOINTS

FREE ENTERPRISE—THE CORNERSTONE OF AMERICAN PROSPERITY

In Canada: The Holden Co., Ltd., Montreal, Canada

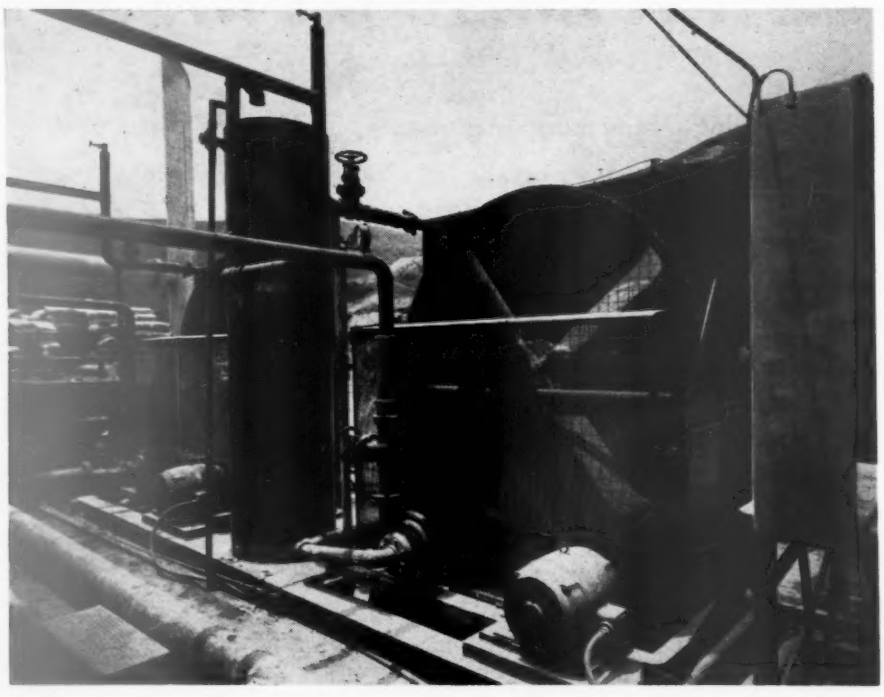
Not just a swivel joint ...but a combination of a swivel and ball joint with rotary motion and responsive movement through every angle.

"MOVE IN EVERY DIRECTION"



Separate cooling on drilling rigs

Young Model 232 jacket water coolers shown in the two pictures are used with a rotary drilling rig owned by Bell Burden, drilling contractors of Los Angeles. Coolers cool the jacket water (also used to cool the lubricating oil) for General Motors quad and twin diesel engines that power the drawworks, rotary table, and mud pump for the rig. Coolers are on separate skid and are easily moved.



RECENTLY there has been put into operation in California a drilling rig using remote jacket water coolers instead of engine mounted radiators.

The principal objection to the separate coolers in the past has been that they constitute another piece of equipment to be moved every time the drilling rig is moved; however, there are advantages to offset this disadvantage.

Some of the features of this type of cooling are:

The principal feature is the power savings in fan loads. For example, when ten 150-hp engines are used, assuming 12-hp fan load per engine if fans were on the engines, this releases 112 more hp to apply to the drilling rig, for the separate cooler uses only 8 fan hp. The cost of the engines in terms of "cost per horsepower" is thus substantially reduced, or, on a cost per horsepower basis, an additional 11 hp per engine has been purchased, not only without additional cost, but actually at a lower price because the engine manufacturer would make an allowance for deduction of the radiator from the power unit. Naturally the cost of the separate coolers has to be considered in the overall cost consideration, but the point is that the 112 hp is available for the rig, and the cost of the separate coolers is largely offset by omission of engine radiators and fans.

The total power required for fan operation is reduced from 120 hp to 8 hp, thus effecting a net fan power requirement savings of 112 hp.

The removal of the cooling units from the rig means a removal of considerable heat within the rig, which is an objectionable feature on engine powered rigs. The engine radiators do not have access to unheated air, frequently at least, and the heat is objectionable to the crews in hot weather.

Use of the separate coolers, situated outside the rig, also removes the noise of high speed fans from the rig. This noise reduction is considered a good factor by the safety department of the oil companies.

Elimination of the engine fans makes possible more efficient maintenance of the engines because the mechanic can detect engine noises and locate trouble more efficiently without fan noise and the fan blast passing over him while working.

By having water pumps on the separate coolers, a constant flow of water can be distributed to all engines regardless of engine speed and engine pump performance. This, together with automatic shutter used on the separate coolers, assures an abundant water supply to all engines at a constant temperature, resulting in lower temperature rise through engines.

The separate coolers can be tied-in to the cooling circuit of either the hydromatic or electric drawworks brakes, thus dispensing with other cooling equipment used for that purpose. ★★★

Directory of exhibits for International Petroleum Exposition

● **Abegg & Reinhold Company, Ltd.**
Los Angeles, California.
Silver Lane, Booths 1 and 2
Exhibit: Automatic drill pipe slips, latch type master bushing, roller kelly bushing, insert kelly bushing, drill collar clamp, 2-man rotary drill pipe slips, unitized rotary drill pipe slips, tri-section rotary drill pipe slips, slush pump liners, slush pump piston rods, sub blanks, self-aligning subs, and swivel washpipes.
Personnel: B. Reinhold, Sr., B. Reinhold, Jr., Roland E. Smith, Knight Templeton, and W. H. Spiri.
Tulsa address: Alvin Hotel.

● **A-1 Bit & Tool Company**
Houston, Texas
Block 104
Exhibit: Rotary type side wall core barrel, wire line core barrels, drilling bits, combination rock-fishtail straight hole bits, combination casing cutters, self-sharpening milling tools, keyseat wipers, water-cooled catheads, and deviation surveying instruments.
Personnel: C. L. Clausel, C. B. McDonald, C. O. Denning, and Harry E. Estes.

● **Accurate Fire Equipment Co.**
Tulsa, Oklahoma
Kansas Building, Booth 38

● **Acme Fishing Tool Company**
Parkersburg, West Virginia
Park Lane, Booth 14.
Exhibit: Cable tool drilling and fishing tools.
Personnel: M. G. Decker and Karl L. Elliott.
Tulsa address: Hotel Tulsa.

● **Acme Oil Tool Company**
Oklahoma City, Oklahoma
California Building, Booths 62 and 63
Exhibit: Acme sucker rod, inside drill pipe and tubing cutters, outside drill pipe cutter, rotary releasing overshot, hydraulic wall hook, long knife perforator, dry ice wash bailer, Spang cable drilling and fishing tools, Shaffer blowout preventers and well control equipment.
Personnel: W. E. Bendeler, Wm. D. Warner, George Prollock, Tom Seago, C. N. Hughes, Harold Sadberry, Rene Crothers, and Paul Raymond.
Tulsa address: Mayo Hotel.

● **Aero Exploration Company**
Tulsa, Oklahoma
Texas Building, Booth 66

● **Aeroquip Sales & Engineering, Ltd.**
Houston, Texas
California Building, Booths 47-48

● **Aerovant Fan Company**
Piqua, Ohio
Texas Building, Booths 44 and 45
Exhibit: Protura cooling tower ring, cooling tower propellers, Mancooling fans, and direct-connected fans.
Personnel: A. W. Roth and James F. Tilton

● **Aetna Ball and Roller Bearing Co.**
Chicago, Illinois
California Building, Booth 42
Exhibit: Heavy duty bearings for oil country equipment.
Personnel: C. W. McNeil.
Houston, Texas
California Building, Booth 47 and 48

● **Ahlberg Bearing Company**
Chicago, Illinois
Oklahoma Building, Booth 169

● **Airetool Manufacturing Company**
Springfield, Ohio
Kansas Building, Booth 41
Exhibit: Fly cutter, condenser tube cut-off tools, boiler tube cut-off tools, pistol grip caliper, valve body caliper, header caliper, buffing cleaners, outside mounted tube cleaners, 3000 Series motor, plastic motor, condenser cleaner mufflers, return bend shaft and cutter, brush head cleaners and flexible connection, single and double expansion tube cleaners and cleaning heads for straight or bent tubes, condenser drills, motor parts, rotors, cylinders, bearings, etc., bundle cleaning lances, push and pull brushes, water feeding devices, sight feed lubricators, automatic lubricators, spiral brushes, blade type heads and expanding brushes, gear drives, tube expanders, tube drifts, collapsing tools, reseating tool, marine out-off tool photographs and designs of catalyst cleaners.
Personnel: Thor Thornson.

● **Air Reduction Sales Company**
New York, New York
Oklahoma Building, Booths 31, 32 and 33
Exhibit: Gas cutting machine, gas and arc welding equipment, No. 10 radiagraph, welding torches, pipe beveling machine, manual heliwelding equipment and flame hardening equipment.
Personnel: H. F. Henriques, J. J. Lincoln, Jr., Dale D. Spoor, Ira B. Yates, W. G. Wicker, G. Van Alstyne, and William C. Bettes.

● **Ajax Iron Works**
Corry, Pennsylvania
Blocks 1 and 9
Exhibit: Steam and gas engines.
Personnel: H. C. Minard and W. F. Freeman.
Tulsa address: H. C. Minard, 1134 North Denver, and W. F. Freeman, 3002 South Boston Court.

● **All American Industries, Inc.**
New York, New York
Texas Building, Booth 47 and 48

● **Allan Company, George B.**
Dallas, Texas
Texas Building, Booth 94 and 95

● **Allan Edwards, Inc.**
Tulsa, Oklahoma
California Building, Booths 4 and 5

● **Allied Bearings & Supply Co.**
Tulsa, Oklahoma
Scientific and Technical Building, Booth 40
Exhibit: Ball and roller bearings, ball and roller type pillow blocks, flange cartridges, bronze bushings, bronze bar stock, electric motor bearings, V-belts and sheaves, speed reducers, speed selectors, change gear boxes, flexible couplings, industrial oil seals, and specialized power transmission equipment.

● **Allied Paint Manufacturing Co.**
Tulsa, Oklahoma
Oklahoma Building, Booth 259
Exhibit: Small roller mill actually grinding paint.
Personnel: Ainslie Perrault, R. M. Gunn, and A. T. Saunders.

● **Allis-Chalmers Manufacturing Co.**
Milwaukee, Wisconsin
Block F
Exhibit: HD19 tractor equipped with a Baker hydraulic bulldozer and a Carco J winch, HD7W tractor equipped with a Baker hydraulic bulldozer and Carco F winch, HD5B tractor equipped with a Gar Wood hydraulic tipdozer, and AD-4 motorgrader.
Personnel: E. R. Hanson and W. S. Barackman.
Tulsa address: Hotel Bliss.

● **Alloy Products Corporation**
Waukesha, Wisconsin
Kansas Building, Booths 56 and 57
Exhibit: Stainless steel sample bombs for hydrocarbon samples, stainless steel welding type fittings, stainless steel drawn sections and fabricated parts.
Personnel: W. J. Wachowitz.

● **Alten's Foundry and Machine Works, Inc.**
Lancaster, Ohio
Oklahoma Building, Booth 115
Exhibit: A-40-TC pumping unit.
Personnel: W. M. Benson.
Tulsa address: Mayo Hotel.

● **Aluminum Company of America**
Pittsburgh, Pennsylvania
Scientific and Technical Building, Booths 52, 53, 54, 55
Exhibit: Aluminum pipe, welded joints and mechanical couplings, galvanized anodes, paint, wires and cables, etc.
Personnel: B. J. Fletcher and staff.

● **American Air Filter Company, Inc.**
Louisville, Kentucky
Texas Building, Booths 16 and 17
Exhibit: Cycoil cleaner, Multi-Duty automatic filter, and Electric-Airmat filter.
Personnel: J. R. McConnell, Arthur Nutting, C. C. Sowerby, D. M. McMakin, and Dallas S. Deem.
Tulsa address: Alvin Hotel.

● **American Airlines**
Tulsa, Oklahoma
Texas Building, Main Entrance
Exhibit: Booth for convenience of passengers traveling to Exposition to make reservations.
Personnel: H. C. Duncan.

● **American Body and Trailer, Inc.**
Oklahoma City, Oklahoma
Block V

● **American Bosch Corporation**
Springfield, Massachusetts
Texas Building, Booths 55 and 56
Exhibit: Diesel fuel injection equipment, farm and industrial magnetos, special service automotive generators and regulators, electric windshield wipers, and ignition coils.
Tulsa address: Alvin Hotel and Adams Hotel.

● **American Brass Company**
Waterbury, Connecticut
Oklahoma Building, Booths 208, 209, 210
Exhibit: Operating mechanism demonstrating efficient heat transfer properties of copper. Various copper alloys in the form of heat exchanger tubes, tube sheets, seamless pump liners, piston finished pump rod, pipe fittings, low temperature bronze repair welds in ferrous metal.
Personnel: D. E. Hotchkiss, H. F. King, W. H. Butterbaugh, H. F. Wallis, Glen Turner, and E. B. Brown.

● **American Bridge Company**
Pittsburgh, Pennsylvania
Oklahoma Building, Booths 136 and 148

● **American Cable Division, American Chain & Cable Company**
Oklahoma Building, Booths 136-148
Exhibit: Tru-lay preformed wire rope for rotary drilling lines; bailing, coring and swabbing lines; tubing and sucker rod lines; winch lines, and Crescent non-preformed wire rope.
Personnel: R. D. McNutt, L. G Moore, W. D. Mercer, R. O. Crenshaw, T. R. Foster, and E. H. Todd.

● **American Car and Foundry Co.**
New York, New York
Block 3 and Block U
Exhibit: Various sizes and types of ACF lubricated full area plug valves.
Personnel: W. R. Kottsieper, L. B. Chapman, W. A. Gormley, and J. M. Reibel.
Tulsa address: Mid-Continent Supply Company, 1304 Philtower Building; Moorlane Company, 409 East Archer Street.

● **American Chain Division, American Chain & Cable Company**
York, Pennsylvania
Oklahoma Building, Booth 157
Exhibit: Winch line tail chains, welded chain for oil field services, heavy duty X-type truck and tractor chains for oil field services.
Personnel: C. A. Goldstrohm and S. A. Poage.

● **American Fort Pitt Steel Spring Division**
H. K. Porter Co.
See H. K. Porter Co.

● **American Iron & Machine Works Co.**
Oklahoma City, Oklahoma
Oklahoma Building, Booths 111 and 112
Exhibit: Straight grip tool joints, power slips, catheads, drill collars, kellys, control head packers, slush pump, standpipe and manifold fittings, slush pump valves and seats.
Peronnel: J. A. Gray, M. G. McCool, J. M. Taylor, Bryan Curtis, F. E. Wagner, Andy Pullen, R. A. Feemster, J. J. Sloan, Austin Brashears, Harry Conley, B. E. Sharp, L. C. Smith, Odus Gardenhire, C. L. Braswell, Joe Castles, Roy Meredith, E. H. Royle, E. E. Rubac, and Claude Griffin.

● **American Manufacturing Co. of Texas**
Fort Worth, Texas
Silver Lane, Booth 35
Exhibit: Colored talking motion picture of new American pumping unit.
Personnel: G. L. Messer, R. S. Hestand, J. E. Lott, and H. D. Biles.

● **American Meter Company**
Scientific and Technical Building, Booths 45, 46, 57, 58
See Westcott & Greis.

● **American Optical Company**
Buffalo, New York
See Triangle Blue Print & Supply Co.
Personnel: W. L. Reynolds. Tulsa address, Alvin Hotel.

● **American Recording Chart Company**
Huntington Park, California
Oklahoma Building, Booths 42 and 43
Exhibit: "Dry air" gas gravitometers, recording liquid gravitometer, recording controlling liquid gravitometer, mercuryless meter, and controlling viscosimeter.
Personnel: J. W. Dunn, W. R. Gay and T. H. Cody.

● **American Roller Bearing Company**
Pittsburgh, Pennsylvania
Silver Lane, Booths 20 and 21
Exhibit: Roller bearings for use in oil well exploration, drilling, and production equipment.
Personnel: W. G. Succop and C. L. Knaak.

● **American Rolling Mill Company**
Middletown, Ohio
East of Block R

● **American Steel Derrick Co.**
Tulsa, Oklahoma
Kansas Building, Booths 1 and 2

● **American Steel Wire Co.**
Cleveland, Ohio
See Oil Well Supply Co.

● **American Sand-Banum Co., Inc.**
New York, New York
Texas Building, Booth 101
Exhibit: Boiler scale and corrosion eliminant, scale and corrosion eliminant for circulating systems of engines where water is recirculated, and radiator cooling system treatment.
Personnel: Frank J. Welu, George A. Krutilek, and Louis Bradie.
Tulsa address: Hotel Tulsa.

● **American Steel Works**
Kansas City, Missouri
Block 102
Exhibit: Agitator pipe line kettle.
Personnel: Glen D. Herrin, John Bahrenfeld, Bob Shackelford.

● **Ampco Metal, Inc.**
Milwaukee, Wisconsin
California Building, Booths 32 and 33
Exhibit: Centrifugal pumps, safety tools, fabricated assemblies and alloys and castings.
Personnel: S. C. Lawson.

● **Anchor Burner Company**
Oklahoma City, Oklahoma
Texas Building Booths, 102, 103 and 108

● **Armco Drainage & Metal Products, Inc.**
Middletown, Ohio
Block S
Exhibiting with parent company, Armco Steel Corporation.

● **Armco Steel Corporation**
Middletown, Ohio
Block S
Exhibit: Spiral welded pipe, casing and conduit, field coating and wrapping procedure and wrinkle bending, corrugated metal drainage structures, tunnel lining, sheeting, quick-coupling pipe, guardrail, steel buildings and tanks, well screens, christmas trees, tubing hangers and measuring lines.
Personnel: R. C. Beam, R. E. Walker, R. O. Hayes, S. R. Ives, H. D. Neill, R. K. Leedom, W. H. Spindler, C. G. Hiskey, R. E. Farquhar, E. H. Holland, G. H. Klouman, Paul Weinman, Wm. F. Elliott, R. L. Wells, Jr., C. J. Coleman, and J. W. Scofield.

● **Armstrong Machine Works**
Three Rivers, Michigan
Texas Building, Booths 94 and 95

● **Athey Products Corporation**
Chicago, Illinois
Blocks C and E
Exhibit: Athey Forged-Trak tractor trailer with "Caterpillar" D7 tractor, Forged-Trak wheel display and Forged-Trak wheels with Texas Flange Co. dolly as used for moving derricks.
Personnel: E. T. Tuller, O. D. Lee, W. I. Bohner, C. E. Jones, and W. J. Hogan.

● **Automatic Motor Base**
Patterson, New Jersey
Block V

● **Axelson Manufacturing Company**
Los Angeles, California
Block 1, Jones & Laughlin Supply Co. Building
Exhibit: Deep well pumping equipment including subsurface pumps and sucker rods and accessories.
Personnel and Tulsa addresses: J. C. Axelson, R. M. Pease, and A. Zwerneman, Mayo Hotel. J. R. Walker and J. O. Willcox, 1503 National Bank of Tulsa Building. Phone: 2-4154. E. W. Brant, H. K. Penny, C. M. Worley, W. R. Lake, E. J. Rhone, and W. A. Russell, residence of Herbert F. Miller, 2165 East 38th Street. Phone: 6-6793. D. L. McDonald, C. W. Duplissey, J. B. Baucum, W. H. Getsinger, C. L. Baker, and C. W. Richardson, residence of Dr. A. B. Bryan, 1624 East 37th Street. Phone: 3-7656. P. A. Puckett, T. L. Reader, C. G. Maguire, E. L. Chandler, J. R. Wilson, C. E. Mullins, and J. E. Hixon, residence of Frank MacKay, 2016 East 20th Street. Phone: 6-9351. F. C. Cummings, 122 South Xanthus. Phone: 2-6304. P. I. Layman, residence of Dr. F. C. Walters, 1221 South Elwood. Phone: 8532. J. W. Rockwell, 332 South Xanthus. Phone: 3-2301. J. D. Brander, 216 West 19th Street. Phone: 4-7051. W. F. Goertz, P. S. Bleudoff, H. F. McCoy, R. E. Berry, M. R. Conger, and A. D. Bolland, residence of Mrs. Jack McMichael, 1203 East 29th Street. Phone: 4-5002.

● **Baash-Ross Tool Company**
Los Angeles, Califnornia
Silver Lane, Booth 33
Exhibit: "DB" and "DHB" unitized blocks, roller kelly drive bushings for square and hexagonal kellys, "DU" rotary slips, "UC" casing slips, drill collar slips, hinged casing spider, two types of safety clamps, fishing tools, casing and landing heads, and power swivel. Baash-Ross equipment also will be shown in several supply company exhibits.
Personnel: B. Bronzan, G. D. Johnson, F. E. Bergeron, Ed Ross, and H. Wotkyns.

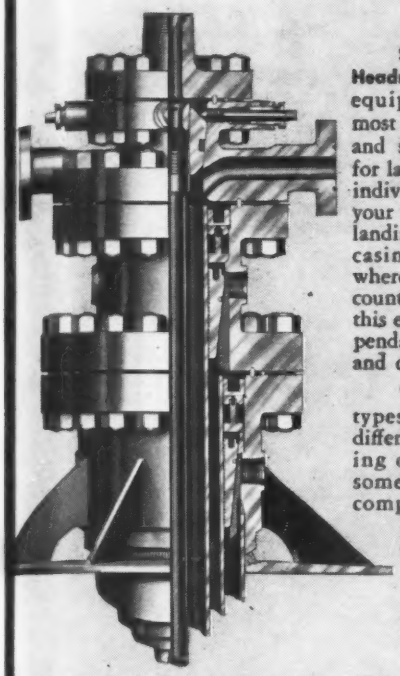
● **Bailey Meter Company**
Cleveland, Ohio
Silver Lane, Booth 40
Exhibit: Area type fluid meter, two-pen Pyrotron, oxygen analyzer and recorder assembly, standard electronic instrument casing, and air operated control systems.
Personnel: C. E. Albert and C. M. Kunkel.

● **Baird Manufacturing Company**
Tulsa, Oklahoma
Texas Building, Booth 15

● **Baker Oil Tools, Inc.**
Los Angeles, California
Oklahoma Building, Booths 99-102
Exhibit: Retrievable cementer, retainer production packer, change-over flow tube, no-left-turn latching sub, tubing seal nipple, tubing seal nipple locator sub, perforated production tube, packer safety joint, triplex cementing equipment, casing centralizer, hydraulic hand pump, male and female cement float collar, cement wash-down whirler float shoe, cement whirler float collar, cement whirler float collar with solid bottom baffle metal petal basket, triplex cement baffle collar, triplex flapper valve float collar, duplex cement wash-down whirler float shoe, multiplex cementing collar, portable hydraulic kelly and pipe straightener, rotary hydraulic expansion wall scraper, rotary casing scraper, junk basket, drill pipe float valve, standard cable tool core barrel, cement retainer, circulation joint, expansion joint, left-hand square thread sub, circulating sub.
Personnel: C. E. Whitney, P. E. Hilton, W.

For maximum safety *IN CASING, TUBING* and *PRODUCTION OPERATIONS* . . .

SHAFFER SPOOL TYPE LANDING HEADS



Shaffer Combination Landing Base Head, with Spool Type Landing Head and Shaffer Type 46 Tubing Head.

Shaffer Spool Type Landing Heads—*pioneer* of this type of equipment—still provide the most advanced, most adaptable and safest equipment available for landing and packing-off each individual string of casing in your wells. They can be used for landing the longest and heaviest casing strings, and on wells where highest pressures are encountered—your assurance that this equipment is completely dependable for modern drilling and completion requirements.

They are available in many types, and in a choice of *five* different packing units for packing off around the casing . . . some with threaded rings for compressing the packing . . . some with no threads whatever in the internal bore . . . and one with an all-metal packing unit ideal for handling certain types of crudes.

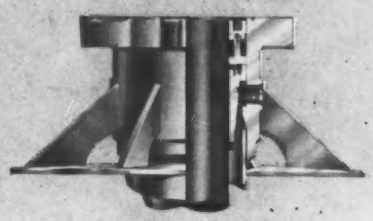
Available in all A.P.I. pressure ratings (Series 400, 600, 900, 1500 and 2500), all Shaffer Heads offer the following vital advantages . . .

- ★ Each individual string is landed with safety at any point desired without any necessity of "letting go," measuring or re-threading.
- ★ Each string is supported on its own flange with an upper flange provided for the support of the next string.
- ★ Each string is suspended on its own set of slips, with no accumulation of weight placed on those slips by subsequent strings of casing and tubing—nor is it affected by any load due to well pressures.
- ★ Each string is packed off securely against high pressure, with provision for gas outlet, mud line or overflow as required, and is packed off independent of any other head in the assembly.
- ★ Each Head is an independent self-contained unit and its packing-off arrangement does not depend upon other heads or flanges to effect a positive seal.

SHAFFER COMBINATION LANDING BASE HEADS

Shown below is a typical Shaffer Combination Landing Base Head—the type of landing head widely used on modern well completions where space is at a premium. These heads—available in 5 different types—provide both a Base and Head in *one* compact unit having a total vertical height equal to *or less than* the height of a conventional head *alone*.

The complete line includes types with standard packing units, with packing units in which no internal threads are used, and a type with all-metal packing unit.



This Shaffer Model A Combination Landing Base Head—one of 5 types available—is typical of the unusual compactness and simplicity of these Base Head units.

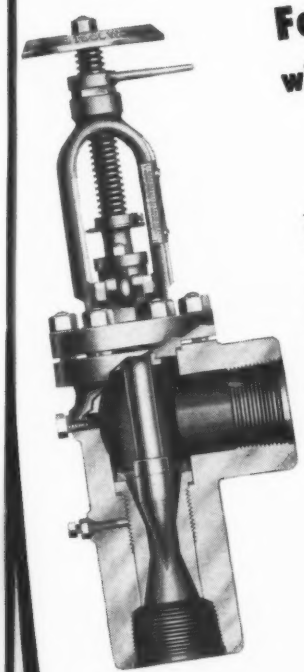
ALL TYPES OF TUBING HEADS

A complete line of Shaffer Tubing Heads is also available to meet every completion requirement—plus multiple zone hook-ups and other special production equipment to meet varied production requirements.

For controlling *FLUID FLOW*

with maximum safety, minimum turbulence—

SHAFFER ADJUSTABLE FLOW BEANS

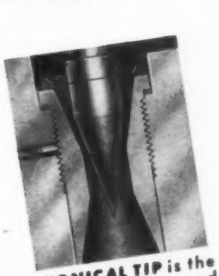


Shaffer is the organization that *pioneered* adjustable flow beans—and Shaffer design embodies *exclusive* features that insure longer life, higher flow efficiency and less maintenance.

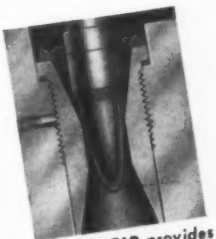
One very important feature is the *double tapered* orifice used in Shaffer Flow Beans. Because the discharge side of the orifice is tapered the same as the entrance side, the fluid flow on the discharge side is expanded *gradually* to the full diameter of the discharge pipe, greatly minimizing turbulence and emulsification.

Because emulsification is reduced, treating costs are lower and greater all around flow efficiency is obtained. Another advantage—Shaffer Flow Beans may be connected so that the flow is either *toward* or *against* the tip, permitting wider versatility for meeting installation requirements.

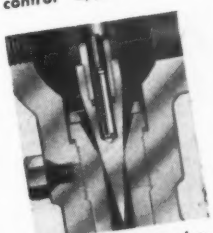
And note at right the various types of tips available with Shaffer Adjustable Flow Beans to meet virtually *any* flow requirement. Widely used for drilling, production and refinery applications, Shaffer Adjustable Flow Beans are available in many types and sizes . . . with flanged or screwed connections . . . bolted or screwed yokes . . . in sizes from 1" to 6" . . . and with pressure ratings to 10,000 lbs. per square inch.



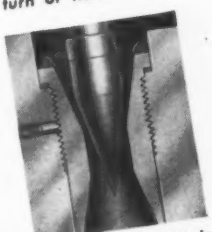
CONICAL TIP is the standard type used for the majority of control applications.



MICRO TIP provides equal increase in opening area for each turn of hand wheel.



THERMO TIP is electrically heated to prevent ice or wax formation in the orifice.



HARD METAL TIP is available in all tip designs to resist abrasive-laden fluids.

SHAFFER

HIGH PRESSURE DRILLING AND CONTROL EQUIPMENT • FISHING TOOLS THAT EXCEL

SHAFFER TOOL WORKS, Brea, California • California Service Shops: Santa Fe Springs and Taft
HOUSTON, TEXAS, 6006 Navigation Blvd. • ODESSA, TEXAS, 1925 West Second Street
OKLAHOMA CITY, OKLAHOMA, Acme Oil Tool Company, 1001 S. E. 29th Street
EXPORT SALES OFFICE: Shaffer Tool Works, 30 Rockefeller Plaza, New York, N. Y., U. S. A.

For the most modern equipment in all types of oil field pressure-control operations, be sure to specify the pioneer—SHAFFER. You will find more details on Shaffer equipment on pages 3843 to 3894 of your 1948 Composite Catalog . . . or send for your free copy of the new Shaffer Catalog!

H. Griffin, R. C. Glover, C. J. Berlin, H. F. Harper, E. F. Hannon, A. K. Kline, G. E. Turner, R. D. McBrian, R. C. Baker, Sr., T. Sutter, H. W. Pullman, E. M. Boggess, F. S. Fobes, W. S. Althouse, A. A. Baker, R. W. Henderson, G. M. Anderson, W. F. Schmidt, M. B. Conrad.

● **Baldwin-Duckworth Division, Chain Belt Co.**
Springfield, Massachusetts
See Chain Belt Company

● **Balmar Corporation, The**
Woodberry, Baltimore, Maryland
Oklahoma Building, Booth 261
Exhibit: Industrial ball joint, Clyde valve, Franklin tank car valve, McLaughlin joint, and Franklin sleeve joint.
Personnel: J. E. Long, A. A. Murison, C. F. Sampson, and J. A. Griffith.

● **Band-It Company**
Denver, Colorado
Oklahoma Building, Booth 79
Exhibit: Tools, stainless steel bands, stainless steel buckles, and clamp warehouses.
Personnel: Ross K. Reed, Val Lodholm, and A. L. Hering.
Tulsa address: Bliss Hotel.

● **B and W Incorporated**
Long Beach, California
Park Lane, Booth 6
Exhibit: Multi-flex scratchers, latch-on centralizers, rotating scratchers, and wall cleaning guides.
Personnel: K. A. Wright and L. L. (Len) Walker.
Tulsa address: Mayo Hotel.

● **Barbour Stockwell Company**
Cambridge, Massachusetts
Block 3
Exhibit: Reliance tachometers, adapters, flexible shafts, and clutches.
Personnel: John J. Whitehouse.

● **Barden Corporation**
Danbury, Connecticut
Scientific and Technical Building, Booth 40

● **Baroid Sales Division, National Lead Company**
Los Angeles, California
Oklahoma Building, Booths 83, 84, 127, and 128, also Block 8
Exhibit: Baroid well logging unit, Autotrol oil and gas separator, Keltner stroke-cycling, cam-lift pumping unit, complete line of mud testing equipment, drilling mud products.
Personnel: R. W. Wilson, Dixon Powers, R. C. Marr, and D. A. Sikes.
Tulsa address: 502 Tulsa Building.

● **Bauer & Black Company**
Chicago, Illinois
Kansas Building, Booths 91 and 92

● **Bausch & Lomb Optical Co.**
Rochester, New York
Scientific and Technical Building, Booth 79

● **Bean Manufacturing Company, John, Division of Food Machinery Corp.**
Lansing, Michigan
California Building, Booth 46
Exhibit: Small capacity, high pressure liquid pumps.
Personnel: Duncan G Hudson.
Tulsa address: Mayo Hotel.

● **Beaumont Iron Works Co.**
Beaumont, Texas
Block 1

● **Bechtel Corporation**
San Francisco, California
Oklahoma Building, 203, 204, 247, 248
Exhibit: Somastic coating display.
Personnel: Austin S. Joy.

● **Bethlehem Steel Company, Inc.**
Bethlehem, Pennsylvania
Silver Lane, Block 9
Exhibit: Bethlehem Steel Company, Bethlehem Supply Company, and Bethlehem Supply Company of California will be joint exhibitors. Bethlehem Steel's exhibit will consist of wire rope, tubular products, sucker rods, forgings, bolting and studding, and tanks (photos). Bethlehem Supply Company will exhibit Tornado drilling rig with new accessories, a Zephyr servicing hoist and coring reel, Whirlwind drilling rig, G-450 power pump, B-21-S rotary table, 100-T and 300-T swivels, and 192-ft Lee C. Moore derrick. These will be displayed outside as an operating display. Other Bethlehem Supply displays will be such suppliers' items as bronze and steel valves, gauge and relief valves, wrenches and wrench kits, steel tape and gauging tape, pipe wipers, mechanical rubber goods, chain belts, wing unions, flashlights, paraffin scrapers, oilers, wire thread brushes, safety hats, safety belts, fittings, swage nipples, bull plugs and cement float shoes, snatch blocks, manila and hemp rope, oil well plunger pumps, Iso-Flow furnace, horizontal reciprocating pumps, light bulbs, and paints.
Personnel: Sales department—C. R. Zimmerman, E. A. Buxton, G. L. LaSchober, Jr., O. E. Berg, N. R. Downie, L. C. Torrell, T. J. Fitzgibbons, C. M. Mackall, B. C. McGregor, R. E. Burns, P. E. Anderson, V. A. Kelly, C. B. Hinton.
Operating department—L. H. Winkler, W. J. Taylor, A. P. Spooner, J. S. Worth, W. J. Pearson, R. S. Barnes, C. D. Meals, E. S. Gingrich.
Publications department—A. A. Warg.
Bethlehem Supply Company: Tulsa office—G. A. Tompson, R. G. Ayers, H. R. Powers, R. E. Dow, V. W. Bailey, C. C. Crider, B. E. Groenewold, T. B. Leech, C. F. Carman, R. L. Neal, W. B. Cotton, R. G. Petri, W. M. Sanders, A. W. Tarkington, G. L. Reid, J. V. Spalding, H. R. Klein, Arthur Weber. Tulsa plant—J. F. Eaton, R. L. Cobb, H. A. Barnes, H. E. Davidson, E. W. Wright. Corsicana plant—I. C. Smith, L. R. Estes, Lee Fagg. Stores division, Field—W. T. Davis, R. A. Johnson, E. S. Lewis, W. E. Stephenson, H. S. Sutton, J. G. Floyd, H. V. Harder, O. H. Crowe, W. J. Brady, J. B. Ellzey, W. A. LaRew, Fred Parks, F. R. House, J. C. Knoll, R. A. Brown, N. G. Blankenship, H. L. Hawkinson, J. T. McKenna. *Bethlehem Supply Company of California*—H. H. Fuller, W. M. Jones, J. W. Hollingsworth, P. B. Erwin, G. E. Pitts, J. C. Graves, Jr.
Tulsa address: Company office at 21 East 2nd Street.

● **Bethlehem Supply Company**
Tulsa, Oklahoma
Silver Lane Block 9
Exhibit: See Bethlehem Steel Company.

● **Bettis Corporation**
Houston, Texas
Block V

● **Bettis Rubber Company**
Los Angeles, California
Texas Drive, Booth 5
Exhibit: Drill pipe protectors and stabilizers, drill pipe wipers, sucker rod protectors and stabilizer installation equipment.
Personnel: B. H. Barnes and H. M. Taylor.
Tulsa address: Park Plaza Courts.

● **Big Three Welding Equipment Co., Inc.**
Tulsa, Oklahoma
Oklahoma Building, Booths 189 and 190
Exhibit: Ransome positioners, Taylor-Winfield resistance welders, Schramm air compressors, Victor welding equipment, and Ohmstede shape and circle cutting machines.
Personnel: E. J. Kiker and C. K. Rickel.

● **Black & Decker Manufacturing Co.**
Townson, Maryland
Texas Building, Booths 38 and 39

● **Black, Sivalls & Bryson, Inc.**
Kansas City, Missouri
California Building, Booths 39, 40, 41, 64, 65, and 66
Exhibit: Model 70 indirect heater, stage separation, chemical feeders, oil seal valve, and separator.
Personnel: A. J. Smith, Verne Palmer, H. B. Fessler, F. C. Myers, Lee Kelton, Ralph Stevens, Ed Nelson, M. R. Waddell, F. L. Carder, and H. L. McLeland.

● **Bonney Forge & Tool Works**
Allentown, Pennsylvania
Kansas Building, Booths 93 and 94
Exhibit: Hand tools, and Weldolet fittings.

● **Boston Woven Hose Co.**
Boston, Massachusetts
West of Block U

● **Bovaird Supply Co., The**
Tulsa, Oklahoma
Block 1, Drake Drive
Exhibit: Roller kelly drive bushings, rotary slips, safety clamps, traveling blocks, rotary tables, swivels, gasoline engines, all-steel rotary hose, salt water disposal pumps, slush pumps, unit pumpers, electric motors, wire rope, power tubing tongs, power sucker rod wrenches, paraffin scrapers, rock bits, elevators, hooks, elevator weldless links, tongs, tubular goods, valves, deep well pumps, rock bits, belting, Tnemec coating, and unions.
Personnel: D. M. Bradley, C. E. Pearson, R. E. Batchelor, V. F. McAnally, R. E. Whitten, L. W. Bartheld, E. T. Auxter, I. N. Downs, Charles McLane, Jr., J. R. McCrea, E. C. Dorroh, B. W. Peoples, N. M. Grove, A. C. Bean, Al Bright.
Tulsa address: Sixth floor, Thompson Building.

● **Bovaird & Seyfang Mfg. Co.**
Bradford, Pennsylvania
Block 11

● **Bowser, Inc.**
Fort Wayne, Indiana
Scientific and Technical Building, Booths 71 and 72
Exhibit: Xacto meter, recording printer dials, for Xacto meters, predetermining dials, Xacto pack pumping and metering unit with flexible cable drive. Rotorol rotary meter with integral air eliminator and strainer, gas trap for oil wells, portable well check unit. Xacto proportioning system, for fire fighting units, filtration system for salt water disposal or repressuring, Rol-Way pump, hose retrieving device, and rotary hand pumps.
Personnel: C. A. Weego, G. W. Cocke, and C. G. Rose.
Tulsa address: Tulsa Hotel.

● **Braden Steel Corporation**
Tulsa, Oklahoma
Block U
Exhibit: Sectional steel building that will be a composite of different types of construction and features.
Personnel: Wm. D. Moorer and L. C. Converse.

● **Bradford Pipe Cement Lining Co.**
Tulsa, Oklahoma
Oklahoma Building, Booth 262
Exhibit: Cement lined pipe, fittings, and packers.
Personnel: Jack B. Wolfe, Morris Fell, and Harold Wolfe.

● **Bradford Pipe & Tool Co.**
Tulsa, Oklahoma
Oklahoma Building, Booth 262

● **Brance-Krachy Co., Inc.**
Houston, Texas
Kansas Building, Booths 48 and 49

● **Brewster Company, Inc., The**
Shreveport, Louisiana
Silver Lane, Block 10
Exhibit: Drawworks, swivels, rotaries, hook and traveling blocks.
Personnel: P. J. Parker, H. B. Marioneaux, J. H. Almand, H. J. Wenk, and A. O. Price.

PROTECTION PLUS!

GARDNER-DENVER

TYPE "FX"

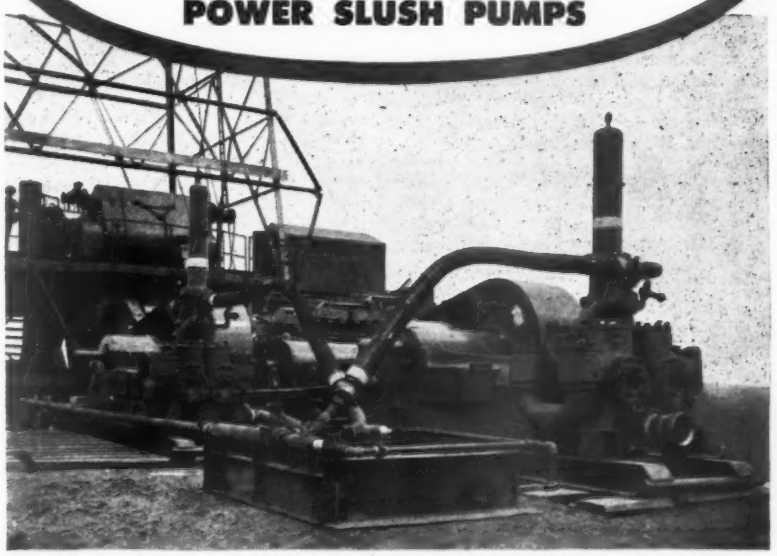
POWER SLUSH PUMPS

▲ Divided fluid cylinder construction of GarDurloy Alloy, developed especially for mud pumps; oil-stop and mud-stop heads positively prevent contamination of lubricant in power end—**Protection from Mud and Water.**

▲ Automatic, controlled lubrication to all working parts—no need for oil pipes; Jackshaft roller bearings are grease packed with pressure gun connections outside the frame—**Protection from Friction.**

▲ Continuous tooth-type Herringbone gear of GarDurloy mixture; exclusive Gardner-Denver eccentric construction provides large bearing area for connecting rods—**Protection from Overloads.**

▲ Rugged, one-piece main frame with reinforced ribs, cast of durable GarDurloy Alloy mixture—**Protection from Shock.**



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Representatives: ARGENTINA • BRAZIL • CHILE • COLOMBIA • ENGLAND • MEXICO • PERU • TRINIDAD • URUGUAY • VENEZUELA

● **Bristol Company**
Waterbury, Connecticut
Scientific and Technical Building, Booths 15 and 16

Exhibit: Air-operated control system, Metameter system of telemetering, Metavane pneumatic transmission system, wide strip dynamaster resistance thermometer, recording flowmeter, recording gauges, and air-operated controllers.

Personnel: H. E. Beane, F. W. Borchers, A. A. Blackman, M. D. Shriver, E. Nuber, C. E. Mason, E. L. Stilson, E. A. Merwin, Walt W. Messner, A. I. Thompson, and G. P. Lonergan.

Tulsa address: Mayo Hotel.

● **Brodie Company, Inc., Ralph N.**
Oakland, California
California Building, Booths 54 and 55

Exhibit: Positive displacement meters and accessories for all applications in the petroleum industry.

Personnel: Earl D. Brodie, J. J. Kropp, and Paul Renfrew.

Tulsa address: Tulsa Hotel.

● **Brown Company**
New York, New York
Kansas Building, Booths 91 and 92

● **Brown Instrument Company**
Philadelphia, Pennsylvania
Scientific and Technical Building, Booths 41, 42, 43

Exhibit: Indicating and recording models of pneumatic Remote Set equipment, flow meters, liquid level control systems, indicating pneumatic flow transmitters, two-pen ratio flow controllers, Electronik pyrometers, Air-o-Line pressure and temperature controllers, integral control bypass, and Air-o-Larm system.

Personnel: R. P. Walker, J. F. Smith, H. P. Hall, and R. L. Mallory.

● **Brown Oil Tools, Inc.**
Houston, Texas
Silver Lane, Booths 22 and 23

● **Brown Well Service of West Texas**
Odessa, Texas
Silver Lane, Booths 22 and 23

● **Bruce-Macbeth Engine Co., The**
Cleveland, Ohio
Block G

Exhibit: 175 hp, natural gas engine, four cycle, five cylinder, vertical, 600 rpm, direct connected to 125 kva, 100 kw at 0.8 power factor, single bearing Westinghouse alternator with top mounted V-belt driven exciter.

Personnel: Max E. Landry, D. D. Macbeth, and B. W. Charlton.

● **Bryant Heater Co.**
Cleveland, Ohio
Block 11

● **Bucyrus-Erie Company**
South Milwaukee, Wisconsin
Block 4

Exhibit: 36-L and 48-L spudders, shown with International Harvester; Dozer-shovel mounted in TD-6 tractor, hydraulic Bullgrader on TD-9 tractor, cable controlled Bullgrader and front mounted P-15 power control winch mounted on TD-24 tractor, and Dozer-Shovel mounted on TD-9 tractor.

Personnel: Emery Heuston.

● **Buda Company, The**
Harvey, Illinois
Block M

Exhibit: Production pumping engines, pipe line gathering service engines, drilling engines, well-servicing engines, pipe line pumping engines, marine engines, oil field lifting jacks, hoisting engines, convertible oil field engines, hydraulic earth drill, hydraulic Universal diesel nozzle tester, supercharged natural gas power unit, natural gas power unit, and diesel-electric generator sets.

Personnel: H. H. Cohenour, J. C. Baseheart, C. E. Wright, Virgil Stover, and George Temple.

Tulsa address: 521 West Archer. Phone: 5-3151.

● **Bunting Brass & Bronze Co.**
Toledo, Ohio
Scientific and Technical Building, Booth 40

● **Burch Agate Torpedo**
Borger, Texas
Scientific and Technical Building, Booth 81

Exhibit: Burch Agate Torpedo; golf course markers in color code.

Personnel: J. Gordon Burch and Iola B. Laffoon.

Tulsa address: Mayo Hotel.

● **Butler Manufacturing Company**
Kansas City, Missouri
Kansas Building, Booths 3, 4, 5, and 6 Block H

Exhibit: A Butler Blue Belle home gas system; oil field heater; cutaway section galvanized tank.

Personnel: Louis Brown, F. B. Todd, J. T. Jennings, Jr., F. A. McAllister, G. A. Burns, Robert Richardson, P. M. Lowry, R. W. Downes, W. E. Botz, W. B. Larkin, R. A. Gasal, G. C. Speakman, R. G. Bloomer.

● **Byron Jackson Company**
Los Angeles, California
Oklahoma Building, Booths 22-27

Exhibit: Pump Division, Oil Tool Division, and Patterson-Ballagh Division will exhibit jointly. The Pump Division will show specially designed miniature pumps and a cross-sectional Fig. 1025 process pump, as well as full size oil industry pumps. The Oil Tool Division will display some nine new pipe handling oil well tools. Patterson-Ballagh's display is listed under that name.

● **Cabot Shops, Inc.**
Block 1
See Jones & Laughlin Supply Co.

● **Cal-Fin Company**
South Pasadene, California
Kansas Building, Booth 25

● **Cameo, Inc.**
Houston, Texas
Silver Lane, Booth 41

Exhibit: Gas lift pressure valves, differential flow valves, check valves, intermitter (surface controller), and tubing mandrels.

Personnel: R. E. Morgan and W. H. Seyffert, Jr.

Tulsa address: Mayo Hotel.

● **Cameron Iron Works, Inc.**
Houston, Texas
Oklahoma Building, Booths 225, 226, 227, and 228

Exhibit: Blowout preventers, flowline valve, new Cameron Type F forged-steel well heads, with several types of tubing and casing hangers and seals, weight indicators, christmas tree flow wings, mud line pressure gauges, and shear relief valves.

Personnel: R. F. Farmer, Joe Tennant, J. M Teague, and Homer Brown.

● **Canedy-Otto Manufacturing Co.**
Chicago Heights, Illinois
Park Lane, Booth 35

● **Cardwell Manufacturing Co., Inc.**
Wichita, Kansas
Block Q

Exhibit: Trailerig, drawworks equipped with air clutches, drawworks manual controls, three-drum cable tool rig with shock absorber equipped mast, cable tool rig with beam attachment, Mobilhoist, single drum well-servicing hoist.

Personnel: Robert M. Smith, Harland Cardwell, Jr., W. O. Timberlake, and James Herrick.

Tulsa address: 723 Wright Building. Phone 3-2531.

● **Carter Oil Company, The**
Tulsa, Oklahoma
Adjacent to Science Building

Exhibit: X-Ray equipment, visual testing apparatus, microscopes, and electrocardiograph, and laboratory facilities.

Personnel: Drs. W. S. Crawford, R. M. Adams, T. H. Mitchell, and James B. Avery.

● **Catawissa Valve and Fittings Co.**
Catawissa, Pennsylvania.
Oklahoma Building, Booths 28 and 29

Exhibit: Forged carbon steel pipe unions, stainless steel pipe unions, forged steel union swing check valves, and iron body union swing check valves.

Personnel: H. Blain Lacy, H. N. Davis, F. Max Long, C. L. Davis, and A. C. Lewis.

Tulsa address: 3415 E. Admiral Court, Hotel Tulsa or Mayo.

● **Caterpillar Tractor Company**
Peoria, Illinois
Blocks C and E

Exhibit: Diesel D8 track-type tractor with Trackson pipelayer, track-type tractor with cable controlled bulldozer and Hyster towing winch, track-type tractor with hydraulic controlled bulldozer and worm drive winch, track-type tractor with Traxcavator, motor grader, diesel engines, diesel marine engine, diesel engine with dual fuel attachment, diesel electric sets.

Personnel: C. E. Jones.

● **Cathodic Servicing Company**
Oklahoma City, Oklahoma
Park Lane Booth No. 18

Exhibit: Miniature elevated steel water tank showing application of cathodic protection, cathodic protection rectifiers, self-cooled and oil immersed models.

Personnel: Miles N. Carmichael, T. M. Riseling, and W. E. Huddleston.

Tulsa address: Mayo Hotel.

● **Cavins Company, The**
Long Beach, California
Park Lane, Booth 31

Exhibit: Drill pipe fishing tool, Depthometer, Quick-change rope socket, perforation washer, and wire line jars.

Personnel: Paul Cavins, Waldo Moore, and Frank Jones.

Tulsa address: Special Nomads' Pullman car parked in Frisco yard.

● **Centaur Division, Le Roi Company**
Greenwich, Ohio
See Le Roi Co.

● **Century Geophysical Corporation**
Tulsa, Oklahoma
Scientific and Technical Building, Booth 62, Block 104

Exhibit: Portable recording equipment, Century hydraulic shot-hole drill, recording trucks and equipment, drill water truck and equipment, shooting truck and equipment, miscellaneous seismic apparatus, and recording truck complete.

Personnel: Opie Dimmick, M. E. Morrow, E. J. Handley, D. R. Weichert, Chas. E. Hendricks, and J. A. Stafford.

● **Chain Belt Company**
Milwaukee, Wisconsin
Texas Building, Booths 70 and 71

Exhibit: Rex oil field chains, Baldwin-Rex roller chain and flexible couplings and Rex Easy-flow Speed prime pumps.

Personnel: Brinton Welser, George Flannigan, George Woodland, Maurice Jewett, Joe Roberts, Bill Klemme, Al Calkins, Ed Rhodes, and Herman Klauke.

● **Chapman Valve Manufacturing Co.**
Indian Orchard, Massachusetts
Texas Building, Booths 24, 25, and 26

Exhibit: 50-in. steel slide valve used in fluid catalytic cracking plants.

Personnel: Ernest Cochran, George E. Fox, Frank Hunter, and E. K. Nickerson.

Tulsa Address: 1445 East 19th Street.

● **Chase Brass & Copper Co.**
Waterbury, Connecticut
Texas Building, Booths 76 and 77

Exhibit: Antimonial admirality, copper tube, cupro-nickel tube, bi-metal tube, red

brass pipe, ventilated bus bar, copper hammer heads, copper nails, brass leg screws, silicon bronze bolts and nuts, bare copper wire, and magnet wire.
Personnel: H. P. Croft, W. J. Wier, W. E. Evans, L. J. Vogler, P. D. Evans, N. W. Mitchell, J. J. Vreeland.

● **Chemical Process Company**
Fort Worth, Texas
Block 1
Exhibit: Acidizing trucks.
Personnel: M. E. Chapman.

● **Chevrolet Motor Division, General Motors Corporation.**
Detroit, Michigan
Between Hall of Science and Exhibit Office
Exhibit: Heavy duty trucks, featuring a 200-hp twin-engine oil-field special extra heavy duty truck-tractor.
Personnel: J. Y. Littleton, A. R. Cosgrove, and T. C. Mallon.
Tulsa address: c/o Mid-West Chevrolet Corporation, 8th and Cincinnati, and George Fuller Chevrolet Company, 4th and Elgin.

● **Chicago Bridge & Iron Company**
Chicago, Illinois
Texas Building, Booths 85 and 86
Exhibit: Horton double-deck floating roof, Horton liquid-seal lifter roof, Vaporsphere, Hortonsphere, and Hortonspheroid.
Personnel: E. P. Shelton, R. A. Jackson, M. G. Mitchell, S. C. Hamilton, C. M. Orr, W. D. Robinson, and D. A. Leach.
Tulsa address: 1308 Hunt Building.

● **Chicago Pneumatic Tool Co., Oil Tool Division**
Oklahoma City, Oklahoma, and New York, New York
California Building, Booths 14 and 15
Exhibit: Three-cone rock bits, reaming bits, reamers, and tool joints
Personnel: E. L. Miller, D. P. Tarpenning, J. B. Steen, L. W. Chadderdon, F. A. Wycoff, and Orville Keller.

● **Chicago Rawhide Manufacturing Co.**
Chicago, Illinois
Kansas Building, Booths 43, 44, 45, and 60

● **Chiksan Company**
Brea, California
California Building, Booths 52 and 53
Exhibit: Chiksan ball bearing swivel joint, Well Equipment Manufacturing Corporation unions, Okadee loading rack valves.
Personnel: L. J. Laird.
Tulsa address: Alvin Hotel.

● **Chromium Plating Company**
Tulsa, Oklahoma
Kansas Building, Booth 42

● **Clark Bros. Company, Inc.**
Olean, New York
Block 11
Exhibit: Midget angle, 8-cylinder, 300 bhp, semi-portable engine-compressor, centrifugal compressor designed for electrical drive by 3500 hp motor.
Personnel: C. P. Clark, D. K. Hutchcraft, F. W. Laverty, George Probst, Fred Hayes, J. N. MacKendrick, E. G. Beardsley, Robert Engleman, and Edward Flaherty.
Tulsa address: Company office at 125 West First Street.

● **Clark Manufacturing Company**
Cleveland, Ohio
Park Lane, Booth 15

● **Clayton Mark & Company**
Evanston, Illinois
Blocks 6, 7, and 8
Exhibit: Petro and Handle-Bar unions and union check valves.
Personnel: Ora C. Cox.
Tulsa address: Tulsa Hotel.

● **Cleveland Diesel Engine Division, General Motors Corporation**
Cleveland, Ohio
Silver Lane, Block 10
Exhibit: Model 567B diesel engine series in ratings of 540, 720, and 1080 bhp. The 540-hp engine will be in operation.
Personnel: Arch F. Campbell, T. E. Hughes, B. H. Gommel, and R. S. Ramsey.
Tulsa address: Tulsa office of company, Philtower Building.

● **Cleveland Trencher Company**
Cleveland, Ohio
Block P
Exhibit: Cleveland Trencher Models 140, 320, and 110; new model Trailer T-10.
Personnel: Vincent Penote, John Penote, J. Roy Overs, N. V. Grund, N. J. Greeney, A. R. Askue, J. N. Dodds, and F. N. Fetzner.

● **Climax Engineering Company**
Clinton, Iowa
Block 107
Exhibit: V-8 drilling engine, models horizontal pumping engines, and D-297 diesel power unit.
Personnel: C. T. Tonkin and Glenn Doyne.
Tulsa address: 15 North Cincinnati.

● **Climax Engineering Company, Controls Division**
Tulsa, Oklahoma
Texas Building, Booths 83, 84, 127, and 128
Exhibit: Separator, liquid level controllers, diaphragm control valves, continuous drainers, back pressure regulators, pressure control pilots, time cycle controllers, and load binders.
Personnel: Jimmy Dvoracek, A. J. Hanssen, W. A. Oberholtzer, T. F. Casey, Jr., Paul E. Bowles, and J. E. Walker.

● **Climax Flexible Coupling Co.**
Cleveland, Ohio
Scientific and Technical Building, Booth 40

● **Coffing Hoist Company**
Danville, Illinois
Silver Lane, Booth 12
Exhibit: "Safety-pull" ratchet lever hoists, electric hoists, jack, spur geared hoists, safety load binders, I-beam trolleys, and differential chain hoists.
Personnel: J. R. Coffing and Ray Doan.

● **Construction Machinery Corporation**
Waterloo, Iowa
Exhibit: With Continental Supply Company and Mid-Continent Supply Company.
Personnel: L. C. Bendit and Harold Lieder.

● **Continental Motors Corporation**
Dallas, Texas
Block P
Exhibit: Continental Red Seal industrial and oil field power units.
Personnel: Bert Brandana and Gene Hanes.

● **Continental Supply Company**
Dallas, Texas
Continental Building, Drake Drive
Exhibit: Inside exhibits include Broderick & Bascom Rope Company wire rope; D & B Pump and Supply Company subsurface equipment, Dayton Rubber Company V-belts; The Lunkenheimer Company valves, cocks, whistles; Clayton Mark and Company unions; New Bedford Cordage Company cordage; New York Belting and Packing Company hose, belting, and packing; Youngstown Sheet and Tube Company drill pipe, tubing, and casing. Outside exhibits include Emsco drilling rigs, rotary machines, crown and traveling blocks, reverse gear, combination traveling block and hook; Gardner-Denver high pressure plunger type power pumps, and sump pump; General Electric generating outfit for auxiliary power and drilling rig, automatic bit weight control and feed-off device; General Motors Series 71 "Quad" drilling engine; Le Roi Model L-3460 drilling engine; Climax Model VU-420 drilling engine; Waukesha Model LROU drilling engine; Maxim heat recovery silencers; Norstrom Merchrome lined valves; Martin-Decker Drillogger; Continental Supply Company C-46, C-66 and C-96 pumping engines; numerous models of pumping units; portable light plant, and Skil drill, saw, and sander.
Personnel: W. J. Morris, F. M. Mayer, F. I. Brinegar, D. D. Dellinger, N. A. Endicott, C. L. Vickers, T. K. Cherry, C. N. Swanson, R. E. F. Schmid, C. R. Gartrell, J. A. Mussler, C. E. Durley, A. J. Olson, J. C. Slonneger, E. M. Fetzer, Jack A. Davis, J. A. Whitesides, Dan G. Webster, Jr., Julio Zumeta, C. J. Delay, J. R. Chapman, R. A. Brewer, R. L. Collier, W. G. Fitzpatrick, E. N. Wood, Chas. H. Fischer, W. R. Gottshall, M. W. McClure, W. T. Hays, T. H. Fraser, A. P. Lacey, E. E. Tyer, Raleigh Hortenstine, L. C. Judy, William D. Craig, B. L. Hindman, F. J. Lafitte, H. E. Lowrey, W. B. Chapman, and Dwight A. Davis.

● **Cook Manufacturing Co., C. Lee**
Louisville, Kentucky
Texas Building, Booths 51 and 52
Exhibit: Metallic rod packing, and graphitic iron piston rings.
Personnel: W. Woobank, T. F. Hudgins, F. Black, W. Mayo, C. J. Kremer, and Robert E. Kirn.
Tulsa address: Woobank Machinery Company, 215-B East Archer.

● **Cooper-Bessemer Corporation, The**
Mt. Vernon, Ohio
Block G
Exhibit: A 10-cylinder, 2400 hp type GMW gas-diesel compressor, a type GMX 4-cylinder compressor, and a Twin-Line liquid pump, which will be direct connected to the GMX.
Personnel: B. L. Potter in charge.
Tulsa address: Company office at 201 East First Street.

● **Cooper, Inc., Fred E.**
Tulsa, Oklahoma
Blocks A, B, and D
Exhibit: Single drum tractor, single drum skid with rotary, double drum skid, single drum tractor with rotary and front controls, a double drum tractor with spudder and mast, single drum skid with seat controls, double drum skid with front controls, double drum tractor with front controls, spudder and mast, double drum tractor with wide front axle, double drum skid with jerkline spudder.
Personnel: Harold E. Cooper, H. B. Bloxom, C. F. Nelson, Ray Kaib, J. A. Cott, B. E. Gladden, Al Graham, Homer Branson, H. R. Kramp, E. E. Everson, Floyd Richardson, Dave Fink, Nolen Varner, Downs Blackburn, Louis Gasche, John Harden, C. H. Hudson, B. R. Wiggins, and Ray Rubottom.

● **Core Laboratories, Inc.**
Dallas 11, Texas
Scientific and Technical Bldg., Booth 4
Exhibit: Exhibit will consist of a mural depicting the various services available for the determination of basic reservoir data and the application of these data to the engineered development and control of oil and gas reservoirs. Typical curves; a visual demonstration of porosity and permeability ("The Bubbling Core"); a special freeze box containing frozen cores; and actual core samples of varying characteristics obtained from many different geological areas in the United States, also will be displayed.
Personnel: W. H. Davison, J. D. Wisenbaker, R. S. Bynum, R. W. Parnell, T. L. Kennerly, J. W. Barbour, and W. E. Stiles.
Tulsa address: 602 East Young Street.

● **Coy Company, Inc., Joseph A.**
Tulsa, Oklahoma
Scientific and Technical Building, Booths 63 and 64
Exhibit: Stratube atmospheric cooling sections and Pow-Air Fin, air-cooled fintube exchanger units.
Personnel: Joseph A. Coy, Hugh R. Lamberth, A. D. Payne, and V. B. Scott.

FOR DEEP DRILLING and HIGH PRESSURES ALWAYS USE

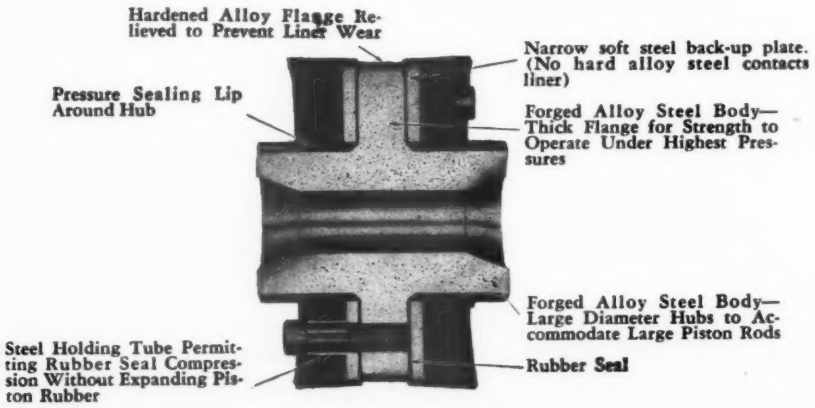
MacClatchie

- "WEAR-EVER" PUMP PISTONS
- "MONEY-SAVER" PUMP LINERS
- "AIRFLOTE" MUD PUMP VALVES
- "SUPER HARD" PISTON RODS
- "GEAROMATIC" CATHEADS
- HYDRAULIC WALL SCRAPERS
- ROTARY UNDERREAMERS
- DRILL GATES & PIPE PACKERS
- ROTATING BLOWOUT PREVENTERS
- "QUICKCHANGE" CEMENT HEADS
- "QUICK" UNIONS
- AUTOMATIC FINGER WITH ALL-STEEL FINGER BOARD
- ALL-STEEL SLIDING PLATFORMS AND "MONKEY BOARDS"
- FLOW BEANS
- "FLEXO" DRILL PIPE AND TUBING WIPER

"WEAR-EVER" TYPE R PUMP PISTONS
with "ALL-PURPOSE TRIPLE XXX" RUBBERS

"THE PISTON WITH THE ECONOMICAL REPLACEABLE RUBBER FEATURE"

TheMacClatchie "Wear-Ever" Type R piston is the latest development in the piston field. The Type R piston has been fully field tested, having out-performed competitive pistons—especially when used under extreme high pressure and severe conditions. Type R pistons are made with "ALL-PURPOSE TRIPLE XXX" rubbers only. This new "ALL-PURPOSE TRIPLE XXX" composition was especially developed for all around use. It works equally well in regular digging, extreme high pressures, hot oil, high temperatures or oil base muds. Cementing companies have found this "ALL-PURPOSE TRIPLE XXX" composition to out-perform anything they have ever used.


Hardened Alloy Flange Relieved to Prevent Liner Wear
Narrow soft steel back-up plate. (No hard alloy steel contacts liner)
Pressure Sealing Lip Around Hub
Forged Alloy Steel Body—Thick Flange for Strength to Operate Under Highest Pressures
Forged Alloy Steel Body—Large Diameter Hubs to Accommodate Large Piston Rods
Steel Holding Tube Permitting Rubber Seal Compression Without Expanding Piston Rubber
Rubber Seal

MacCLATCHIE MANUFACTURING COMPANY

Main Office, Plant and Export Office: COMPTON, CALIFORNIA

Mid-Continent Distributor:
Hake Tool Co., Houston, Texas

Rocky Mountain District:
MacClatchie Mfg. Co., Artesia, Colo.

Calgary, Alberta, Canada: Oil Equipment, Ltd

● **Crane Co.**
Chicago, Illinois
Oklahoma Building, Booths 196, 197, 254, and 255

Exhibit: Steel valves, the 600-lb line of cast and forged steel valves, 6-inch iron valves, 6-inch pressure-seal-bonnet valve in cross-section, pipe coil to indicate Crane's piping fabrication facilities, and two motor-operated valves.

Personnel: F. J. Wilkey, R. A. Hendrickson, Eric R. Seabloom, A. H. Hahn, R. O. Brendel, R. G. Hunter, and Vernon Kornhaus.

● **Crane Packing Company**
Chicago, Illinois, and Houston, Texas
Kansas Building, Booth 26

● **Crosby Steam Gage & Valve Co.**
Boston, Massachusetts
Scientific and Technical Building, Booths 45, 46, 57, and 58

Exhibit: Sectional relief valves and steam safety valves, pressure indicating gages.

Personnel: Erling Klafstad, John Gieseke, and O. L. Patrick.

Tulsa address: c/o Westcott & Greis, Inc., Kennedy Building.

● **Crose Manufacturing Co., M. J., Inc.**
Tulsa, Oklahoma
East of Kansas Building

Exhibit: Traveling type pipe cleaning and priming machines, internal line-up clamps, electrically operated internal line-up clamps, stationary type hydraulically operated pipe cleaning and priming machine, stationary type coating and wrapping machine, pipe line coating kettles with agitator, and road boring machine.

Personnel: Michael Curran and M. J. "Whitey" Crose.

● **Cummins Engine Company, Inc.**
Columbus, Indiana
Block 104

Exhibit: Cummins Models to be displayed in Block 104 by Cummins Sales and Service, Inc., Fort Worth, Texas, and Mid-Continent Cummins Export Corporation, Fort Worth, Texas, include an activated, cutaway version of a Model NHBS-600 Cummins diesel; cutaway model of the exclusive Cummins fuel pump and an accompanying exhibit of Cummins fuel pump parts; a selection of translite photographs on a lighted board of applications of Cummins diesels in the petroleum industry, and Models NHP-600 and NHMS-600 Cummins diesels. The former is a completely enclosed power unit of the "NH" Series rated up to a maximum of 200 hp at 2100 rpm. Model NHMS-600 is a 6-cylinder, supercharged marine diesel, with a maximum rating of 275 hp at 2100 rpm. Other Cummins diesels will be shown by Mid-Continent Supply Company in Block 3 and other oil equipment manufacturers and supply companies.

Personnel: G. W. Stevens, J. I. Miller, R. E. Huthsteiner, L. W. Beck, W. M. Harrison, and E. G. Crouch.

● **Curtin & Company, W. H.**
Houston, Texas
Scientific and Technical Building, Booth 79

Exhibit: Hand driven and electric centrifuges, analytical balance, oil refractometer, fractional distillation apparatus, thermometers, hydrometers, drilling mud viscosimeter, drilling mud filter press, infra-red spectrophotometer, ultraviolet spectrophotometer, flame photometer, radiation meter, stereoscopic microscope, constant temperature porcelainware, laboratory glassware, filter paper, metering valves, purity meter, electric hot plate, battery and ac operated pH meters, electric furnaces.

Personnel: K. H. Clough and C. G. Albert.

Tulsa address: Tulsa Hotel.

● **Cyclone Fence Division, American Steel Wire Co.**
Pittsburgh, Pennsylvania
See Oil Well Supply Co.

● **Daniel Orifice Fitting Company**
Los Angeles, California, and Houston, Texas
Scientfic and Technical Building, Booth 86

Exhibit: The new simplex, senior orifice fitting, piston type check valve, laboratory bombs, Jerguson liquid level gages, Ashcraft pressure gages, American thermometers, consolidated relief valve, P. E. Madden continuous blow-down system.

Personnel: W. A. Griffin.

Tulsa address: 310 Thompson Building. Phone: 3-3303.

● **Darling Valve & Manufacturing Co.**
Williamsport, Pennsylvania
Oklahoma Building, Booths 113 and 114

Exhibit: Cast-steel pipe line valves, iron body pipe line valves, iron body pipe line check valves, cast-steel refinery valves, electrically operated gate valve, electrically operated cast-steel gate valves, special valves for use on corrosive service.

Personnel: H. B. Foster, D. F. Sable, and C. H. Simon.

Tulsa address: Company office at 310 Thompson Building.

● **Davis Regulator Company**
Chicago, Illinois
Scientific and Technical Building, Booths 45, 46, 57, and 58

Exhibit: Gas back pressure valves.

Personnel: R. A. Peterson.

Tulsa address: Westcott & Greis, Inc.

● **D-B Pump and Supply Company**
Los Angeles, California, and Dallas, Texas
Continental Building, Drake Drive
See Continental Supply Company

● **Dayton Rubber Company**
Dayton, Ohio
Oklahoma Building, Booth 211, and Block 8

Exhibit: V-belt drives, made from rayon cord, and special preformed cog belt.

Personnel: T. C. Davis, J. D. Hershey, N. D. Baker, E. P. Spore, R. L. Scott, J. L. West, C. M. Bjorkman, J. G. Hendricks, W. H. Wood.

● **Dearborn Chemical Company**
Chicago, Illinois
Texas Building, Booths 106 and 107

Exhibit: NO-OX-ID wrap, water treating and testing equipment, pipe line protective coating and wrappers.

Personnel: C. B. Smith, E. M. Converse, T. L. Holcomb, P. B. Payne, T. Kennedy, J. M. Halton, and R. W. Kelly.

Tulsa address: 208 Midco Building.

● **Deckard Manufacturing Co.**
Tulsa, Oklahoma
Block 3

● **Deep Rock Oil Corporation.**
Chicago, Illinois
Kansas Building, Booths 28 and 29

Exhibit: Backdrop with blown up photographs of oil activities with a display of lubricating oil containers.

Personnel: J. C. Tillery, L. E. Thompson, F. L. Miles, and J. H. Duncan.

● **Delco-Remy Division, General Motors Corporation**
Anderson, Indiana
Silver Lane, Block 10

Exhibit: Electrical equipment for trucks and tractors, gasoline and diesel engines, generators, regulators, cranking motors, ignition distributors, ignition coils, switches, and batteries.

Personnel: Foust Childers.

Tulsa address: Mayo Hotel.

● **De Luxe Products Corporation**
La Porte, Indiana
Block 3

● **Detroit Diesel Engine Division, General Motors Corporation**
Detroit, Michigan
Silver Lane, Block 10

Exhibit: GM Series 71 diesel engines as follows: 520-bhp Quad 6, three 260-bhp Twin 6's, 174-bhp Twin 4, 2, 3, 4, and 6-cylinder engines ranging from 46 to 138 bhp, 60-kw electric generating set. Series 71 Twin 4 Diesel Model 8-103 rated at 174 continuous bhp will be shown for first time.

Personnel: V. C. Genn, Arch F. Campbell, R. L. Burpee, and M. G. Fullington.

Tulsa address: Company office, Philtower Building.

● **Devine Division, J. P.**
H. K. Porter Co.
See H. K. Porter Co.

● **Dia-Log Company**
Kilgore, Texas
Silver Lane, Booth 10

Exhibit: Tubing and casing survey tools, drill pipe back-off demonstration using one-tenth size equipment.

Personnel: J. M. Kline, J. P. Kline, B. R. McNulty.

Tulsa address: Whitt's Motel.

● **Diamond Chain Company, Inc.**
Indianapolis, Indiana
Scientific and Technical Building, Booths 11 and 12

Exhibit: Roller chains and sprockets, flexible shaft couplings.

Personnel: G. A. Wainwright, C. P. Kottlowski, A. S. Basten, W. A. Warrick, J. L. Wamsley, G. G. Mize, T. Paul Jackson, P. C. Merchant, W. C. Covert, Harry Morrow, O. T. Meginnis, and D. G. Viskniskki.

● **Diesel Supply Company**
Joplin, Missouri
Park Lane, Booth 10

● **Dietzgen Company, Eugene**
Chicago, Illinois
Oklahoma Building, Booth 236

● **Dollinger Corporation**
Rochester, New York
Oklahoma Building, Booth 207

Exhibit: Complete line of Staynew air, gas, and liquid filters.

Personnel: Lewis L. Dollinger, Jr., and Fred Thilenius.

Tulsa address: Thilenius Equipment Co.

● **Double Seal Ring Company**
Fort Worth, Texas
Park Lane, Booth 16

Exhibit: One-piece compression ring, one-piece oil ring, ventilated type oil ring, and various kinds of piston rod packing.

Personnel: R. W. Hoyt, Buyrl Wilson, Jim Ritchie, C. R. Clingman, E. D. Darnell, F. J. Welu, and George Krutilek.

Tulsa address: Adams, Bliss and Tulsa Hotels.

● **Dowell Incorporated**
Tulsa, Oklahoma
Block Y, Skelly Drive

Exhibit: Display of Dowell's latest oil well acidizing treating unit. Exhibit of selective acidizing, Spinner, surveys and the model of the Spinner, water locater, caliper survey, cathodic protection service, jet gun, jetflake which is used for lost circulation in oil and gas wells, paraffin solvents, bulk chemicals, plastic service, permeability survey, scale removal from heat exchange equipment.

● **Dresser Manufacturing Division, Dresser Industries, Inc.**
Bradford, Pennsylvania
Block 11

Exhibit: Dresser couplings and long sleeves boltless fittings for small piping, repair clamps and repair sleeves, and welding ells.

Personnel: H. P. Boncher, H. Z. Hight, and E. E. Peavy.

● **Duff-Norton Manufacturing Co., The**
Pittsburgh, Pennsylvania
Oklahoma Building, Booths 154 and 155

Exhibit: Air motor power jacks, governor controlled self-lowering jacks, speed controlled self-lowering jacks, low height screw jacks, trench braces, bell base jacks, push and pull jacks, automatic lowering jacks, oil well jacks,

Announcing . . . .

A New Gear Catalog with Information and Data Compiled for users of Industrial Speed Reducers and Increasers.

A NEW and complete line of Industrial Herringbone Gear Reducers and Increasers is now available at Lufkin. AND deliveries can be made promptly —within ten weeks on most sizes and within 16 weeks on any size.

For twenty-five years Lufkin has manufactured heavy duty speed reducers for oil field pumping service—a service which is generally regarded as one of the most severe applications for gears.

Lufkin has also for many years manufactured a large quantity of special gear reducers and speed increasers for a wide variety of industries.

Within the fields covered, Lufkin has long been recognized as THE outstanding manufacturer of quality and dependable gear units.

Out of this invaluable background of experience Lufkin now offers a new and complete standard line of horizontal parallel-shaft Herringbone Gear Speed Reducers and Increasers. There is now a Standard Lufkin Gear Unit Assembly of this type available for any power transmission job and—of equal importance—deliveries can be made promptly.

Our new Gear Catalog G-1, which will be mailed to you upon request, furnishes complete information on Horsepower Ratings, Dimensions and Application Data. Send for a copy.

• • • • A NEW SOURCE FOR YOUR GEAR REQUIREMENTS

LUFKIN INDUSTRIAL GEAR ASSEMBLIES ARE AVAILABLE IN THREE STANDARD TYPES

TYPE S

TYPE S Single Reduction Gear Speed Reducers are built in a complete range of sizes from 3 to 500 horsepower with any gear ratio up to 10:1.

TYPE D Double Reduction Gear Reducers are built with a complete range of ratios from 10:1 up to 75:1 in sizes from 1 to 300 horsepower.

TYPE N High Speed Gear Reducers and Speed Increasers are available in 33 sizes with any ratio up to 12:1. Loads up to several thousand horsepower can be transmitted; normal speed range 3600 to 9000 RPM. Pressure lubrication and cooling system are standard equipment.

TYPE D

TYPE N

This valuable information and data will bring your file up to date

Lufkin Foundry & Machine Co.,
Lufkin, Texas.

Gentlemen:

Please have salesman call to discuss our present gear problems_____

Please forward copy of Gear Catalog G-1 to:

Name_____ Title_____

Firm_____

Principal Business_____

Mailing Address_____
Street or P. O. Box

City_____ State_____

12, 20, 25, and 30-ton hydraulic jacks, aluminum track jack, 30-ton hydraulic jack with independent pump.

Personnel: W. I. Floyd, D. Christopher, W. W. Moody, T. W. Krueger, and E. C. Gunther.

● **Du Pont de Nemours and Co., E. I.**
Wilmington, Delaware
Texas Building, Booths 96-100 and 111-115, inclusive.

Exhibit: Tetraethyl lead compounds, gasoline oxidation inhibitors, oil soluble colors, lubricating oil additives, fuel oil additives, "Nitramon" S, "Nitramon" WW, "SSS" blasting caps, special oil well explosive, and Neoprene products.

Personnel: Charles S. Gunby, P. F. Lewis, W. E. Danley, G. H. Loving, R. O. Cash, A. L. Nixon, T. H. Michell, Charles Wirth III, Robert M. Glover, Jr., William D. Morehouse, D. W. Frison, J. A. Hyland, E. M. Fanning, V. A. Cosler, S. W. McCune 111, R. S. Griffin, E. S. Latimore.

Tulsa address: 1811 South Baltimore Avenue. Phone: 5-5578 or 5-5579.

● **Durametallic Corporation**
Kalamazoo, Michigan
Texas Building, Booth 14

Exhibit: Packings, mechanical rotary seal, and packing tools.

Personnel: Roscoe R. Smith, W. D. Emery, Richard D. Hall, Allison Walker, Robert Van Blaricom, Dale Fontaine, and L. J. Gregory.

Tulsa address: 427 McBirney Building.

● **Eastman Oil Well Survey Company**
Denver, Colorado
Scientific and Technical Building, Booths 44-59

Exhibit: Controlled directional drilling tools, oil well surveying instruments, electronic equipment for temperature and water entry determination, and Corex core orientation instruments.

Personnel: H. John Eastman, Gordon Jackson, Ted W. Sess, Wm. G. James, Clyde Stokenbury, J. B. Murdock, Jr., Wm. L. Carwile, John Cochran, W. H. Cook, John C. Duncan, Joe E. Edwards, Ralph Goble, Onos M. Lindsay, A. R. MacLagan, and Oliver V. Phillips.

Tulsa address: Tulsa Hotel.

● **Eberhardt-Denver Company**
Denver, Colorado
See Allied Bearing Supply Co.

● **Edward Valves, Inc.**
East Chicago, Indiana
Scientific and Technical Building, Booths 33-38

Exhibit: See Rockwell Manufacturing Company.

● **Electric Hose and Rubber Co.**
Wilmington, Delaware
Oklahoma Building, Booth 62

Personnel: George T. Hamann, V. W. Wells, R. W. Bauer.

Tulsa address: Tulsa Hotel.

● **Elliott Company**
Jeannette, Pennsylvania
Oklahoma Building, Booths 125 and 126

Exhibit: Type YR mechanical drive turbine and representative sizes and types of tube cleaners.

Personnel: J. N. McClure, J. A. Wilson, J. M. Maag, W. E. Widau, and F. W. Dohring.

Tulsa address: Company office at 616 Mc Birney Building.

● **Elliott Manufacturing Co.**
Los Angeles, California
Block 3

● **Emerol Manufacturing Company**
New York, New York
Oklahoma Building, Booths 123 and 124

Exhibit: Marvel inverse oiler (top cylinder lubricator) and Marvel mystery oil for use with the inverse oiler.

Personnel: C. B. Pierce and W. C. Pierce.

● **Emsco Derrick & Equipment Co.**
Los Angeles, California

Equipment will be shown by Continental Supply Company, Bovaird Supply Company, and Mid-Continent Supply Company.

● **Enardo Foundry & Manufacturing Company**
Tulsa, Oklahoma
Oklahoma Building, Booth 163

● **Engineering Laboratories, Inc.**
Tulsa, Oklahoma
Scientific and Technical Building, Booths 22 and 78, and Block 104

Exhibit: Gagetron, which controls and/or measures liquid levels through thick tank walls.

Personnel: W. G. Green, R. B. McCullar, J. V. Bowman, J. W. McLendon, B. M. Baker, W. M. Wells, F. R. Wheeler, C. E. Wofford, O. W. Graham, J. D. Schroeder, E. F. Gahan, C. E. Dietert, M. P. Ragan, L. M. Swift, J. E. Caywood, S. O. Snyder, T. E. Williamson, M. D. Carter, Dan Warden, and M. H. Gomez.

● **Ensign Carburetor Company**
Huntington Park, California
Texas Building, Booth 69

Exhibit: Carburetor and gas regulator in section for updraft installation, carburetor and gas regulator in section for downdraft installation, combination gasoline and dry gas carburetor, butane-propane carburetion equipment, and carburetor known as model "Xg".

Personnel: R. R. Wyker, R. G. Abbott, A. J. St. George, L. G. Smith, and Grant W. Keller.

● **Ever-Tite Coupling Company**
New York, New York
California Building, Booth 56

● **Faber Engineering Company, Inc.**
Philadelphia, Pennsylvania
California Building, Booths 4 and 5

Exhibit: Oil and gas burning equipment.

Personnel: Allan Edwards, Inc., and H. A. Frey.

Tulsa address: 505 McBirney Building.

● **Fafnir Bearing Company**
New Britain, Connecticut
Scientific and Technical Building, Booth 40

● **Failing Supply Co., George E.**
Enid, Oklahoma
Block 10

Exhibit: 1500 Holemaster drill, 750 Holemaster Sizmo drill, 2500 Holemaster drill, and other equipment.

Personnel: Geo. E. Failing, Robert M. Greer, H. J. Godschalk, Robert H. Failing, J. C. Failing, Walter Buller, E. L. Alexander, Joel Yarborough, V. C. Mickle, Merle Fitzgerald, Harold Holden, Burt Pedigo, Ray Keltner, Jimmy Helton, Russell Cowherd, Clyde Baker, Jack Felton, Jack Boyd, Kay Peters, Friday Fitzgerald, Ray Lewman, and G. P. Gregory, Jr.

● **Fairbanks Company, The**
New York, New York
California Building, Booths 50 and 51

Exhibit: Bronze and iron body valves, steel-framed hand and platform trucks, and drum handling equipment.

Personnel: R. C. Macbeth, C. L. Haslup, L. Compton, K. M. McClean, J. J. Langan, and R. W. Draughon.

● **Fairbanks, Morse and Co.**
Chicago, Illinois
California Building, Booths 10, 11, 12, and 13

Exhibit: Engines, pumps, and motors.

Personnel: W. S. Johnson, Harry Shelton, P. P. Kizis, F. J. Cinatl, H. J. Renken, H. L. Hilleary, E. C. Rauschkolb, John W. Michel, T. E. Woodruff, Louis Mink, J. S. King, W. B. Kella, W. W. Guernsey, Glenn Parker, J. S. Peterson, H. E. Brown, P. S. Procter, and H. D. Gobble.

Tulsa address: Mayo Hotel.

● **Fairbanks, Morse & Co. (Magneto Sales)**
Beloit, Wisconsin
Kansas Building, Booth 37

Exhibit: Magnetos.

Personnel: F. J. Bartella, L. D. Morris, and R. A. Fiedler.

Tulsa address: Alvin Hotel.

● **Farrel-Birmingham Company, Inc.**
Buffalo, New York
Oklahoma Building, Booth 191

Exhibit: Photograph translites showing installations or gear units in oil field service. Also translites showing the company's plants; and products for use in oil field service, pipe line pumping stations and refineries, including speed increasing units, speed reducing units, deep well pump drives, gears and flexible couplings. Display of various types of gearflex couplings, rotary pumps with Sykes gear rotors, small Sykes herringbone gears, and photographs and engineering data relating to products.

Personnel: R. G. Wilson, John Brandt, T. V. Busk, V. W. Osborne, Walter Domagalla, and C. M. Peterson.

● **Farris Engineering Corporation**
Palisades Park, New Jersey
Silver Lane, Booth 32

Exhibit: Safety relief valves, corrosion relief valve, rubber pinch valve, high pressure, semi-nozzle bar-stock relief valve.

Personnel: Victor W. Farris.

Tulsa address: 207 Citizen's Bank Building. L. D. McKay & Co.

● **Fawick Airflex Co., Inc.**
Cleveland, Ohio
Oklahoma Building, Booths 257 and 258

Exhibit: Type CB clutches, Type E clutches, and Type C clutches.

Personnel: T. L. Fawick, R. S. Huxtable, J. B. Kelley, J. V. Eakin, N. A. D'Arcy, Jr.

Tulsa address: Hotel Bliss.

● **Findlay Division of Gar Wood Industries, Inc.**
Findlay, Ohio
Block 13
See Gar Wood Industries, Inc.

● **Fischer & Porter Company**
Hatboro, Pennsylvania
Scientific and Technical Building, Booth 25

Exhibit: Ratosleeve flowrator instrument for large flows, Armored flowrater instrument for high temperature and pressure, electronic recorder-controller for tiny flows, ratio controller, viscorator continuous viscosimeter, specific gravity tester, and new air or gas driven totalizer.

Personnel: W. A. Diament, H. F. Lorence, D. J. Condit, and R. W. Fritzsche.

● **Fisher Governor Company**
Marshalltown, Iowa
Texas Building, Booths 78 and 79

Exhibit: Pressure regulators, pilot operated regulators, liquid level controllers, lever and float valves, traps and strainers.

Personnel: P. A. Elfers, T. B. Burris, Lyle E. Eige, A. E. Ehrke, R. A. Engel, and G. F. Brockett.

Tulsa address: Vinson Supply Company, 220 North Boston.

● **Fitler Company, Edwin H.**
Philadelphia, Pennsylvania
Texas Drive, Booth 4

Exhibit: No special items.

Personnel: James A. England and Chas. Krpec.

Tulsa address: 1181 North Boston Street.

● **Flex-Rite Valve & Manufacturing Co.**
Tulsa, Oklahoma
Texas Building, Booth 11

● **Flint Steel Corporation**
Tulsa, Oklahoma
Scientific and Technical Building, Booths 20 and 21

Exhibit: Bank of multitubular heat ex-

changers, miniature transmission tower, display of photographs of equipment.

Personnel: C. M. Cooper, D. E. Fields, H. G. Lewis, C. F. Mooney, S. L. Spence, and H. A. Hofflander.

- **Fluid Packed Pump Company**
  Los Nietos, California
  California Building, Booths 1 and 2

Exhibit: Oil well pumps and parts.

Personnel: Glen Peters, G. R. Newbolt, and C. D. Newbolt.

Tulsa address: Tulsa Hotel.

- **Fluor Corporation, Ltd., The**
  Los Angeles, California
  Scientific and Technical Building, Booths 47 and 48

Exhibit: Pulsation dampener working model.

Personnel: J. R. Fluor, J. R. Wiseman, F. M. Stephens, G. H. Dieter, C. Yates, M. A. Ellsworth, C. F. Royse, C. E. Pickup, D. H. White, and C. E. Gregg.

Tulsa address: 229 Mayo Building.

- **Foote Bros. Gear and Machine Corp.**
  Chicago, Illinois
  Block G

Exhibit: Worm gear speed reducers, helical gear speed reducers, cut gears of all types, flexible shaft couplings.

Personnel: Max E. Landry.

Tulsa address: 533 Mayo Building.

- **Formica Insulation Company**
  Cincinnati, Ohio
  Silver Lane, Booth 14

- **Foster Cathead Company**
  Wichita Falls, Texas
  Texas Building, Booths 12 and 13.

Exhibit: Spinning cathead, master cathead, and "catworks."

Personnel: W. M. Foster, Gordon T. West, J. Lewis Foster, and I. J. Farrier.

Tulsa address: Wells Hotel.

- **Four Wheel Drive Auto Co., The**
  Clintonville, Wisconsin
  Block N, and East of Block N

Exhibit: FWD trucks. Two models will be mounted with Leland low-bed type oil field body complete with winches, headache posts, etc.

Personnel: W. C. Merrill and Robert E. Meek.

Tulsa address: The Leland Equipment Company.

- **Foxboro Company, The**
  Foxboro, Massachusetts
  Scientific and Technical Building, Booths 18, 19, and 65

Exhibit: Dew point recorder, gas-powered integrating flow meter, tubing and casing pressure recorder, auto-selector controller for pump discharge or suction, pneumatic-operated engine governor, Model 40 controller, Model 41 indicating controller, D/P cell (differential pressure) transmitter used with pneumatic and electronic recorders, EMF and resistance bulb Dynalog (all-electronic) recorders.

Personnel: C. E. Sullivan, H. O. Ehrisman, D. M. Hill, V. V. Tivy, L. K. Spink, D. H. Fuller, J. J. Burnett, W. A. Melton, F. D. Brindel, E. L. Stark, R. H. Hemfelt, J. E. Hendricks, L. W. Parten, E. E. Kleir, W. A. Rock, J. B. Deaderick, E. R. Huckman, and J. J. Connelly.

Tulsa address: Hotel Tulsa.

- **Fram Corporation**
  Providence, R. I.
  Oklahoma Building, Booths 116 and 117

- **France Packing Company**
  Philadelphia, Pennsylvania
  Texas Building, Booth 72

Exhibit: Packing for all applications in petro-chemical industries, packing rings, and industrial piston rings.

Personnel: E. A. France and M. E. Boulden.

- **Franks Machine Company**
  Enid, Oklahoma
  Block 104

- **Franks Manufacturing Corporation**
  Tulsa, Oklahoma
  Block Z

Exhibit: Double-jointed, 130-ft, thribble jack-knife derrick; a skid-type drawworks designed for deep workover and medium depth drilling; telescoping derrick unit; self-propelled drilling unit carrying its own telescoping derrick unit; self-propelled light complete drilling unit for water, shallow oil well drilling and stratographic testing; full-air control box; "Donut" and "Diaphram" air clutches; hydraulic auto-equalizing clutch-dogs with single point adjustment.

Personnel: Carl White, Jr., R. M. White, L. E. Ferguson, Earl Kirberger, V. K. Chapman, Joe Byrd, W. B. Woody, Albert Hastings, Kenneth Lamer, Tommy Knobloch, Vern Alley, George Lewis, Doug Lawrence, John G. Leyh, and Mike Pallein.

Tulsa address: Phone: 9-6381.

- **Frost Geophysical Corporation**
  Tulsa, Oklahoma
  Oklahoma Building, Booth 161

Exhibit: Gravity meter, gravity maps, airborne magnetometer, and magnetic maps.

Personnel: C. H. Frost, Joseph A. Sharpe, John H. Hidy, J. C. Rollins.

- **Fulton Sylphon Company**
  Knoxville, Tennessee
  Oklahoma Building, Booth 170

- **Gardner-Denver Company**
  Quincy, Illinois
  Blocks 3 and 8

Exhibit: Cement pump, slush pumps, portable slush pump, centrifugal pumps, air-starting motors.

Personnel: R. H. Rodolf, R. J. Bauer, C. E. Wortman, and C. W. McKey.

Tulsa address: Branch office, 309 South Cincinnati Avenue.

New! Improved!

PARAFFIN CONTROL TOOLS

SIW

The SIW Paraffin Scraper type M-25 is a new, improved tool that keeps wells from choking down with paraffin and eliminates the problem of pulling and running the pump. These field-tested scrapers have proved their worth in fields where wax presents a real problem. Because of the long tapered wings this paraffin scraper can easily be run into the tubing and can be used with a rod stripper. The new SIW Paraffin Scraper, which has become standard equipment by several companies, can be easily attached to new or used rods in the field by use of special tools provided by Sunshine Iron Works. For further information, write or call Sunshine Iron Works.

S-I-W PARAFFIN SCRAPER
TYPE M-25

Sunshine Iron Works

601 W. MURPHY - PHONE 4374 - ODESSA, TEXAS

● **Garrett Oil Tools**
Longview, Texas
Park Lane, Booth 11 and Block 104

Exhibit: Valve and mandrels, several types of valves, and controller.

Personnel: Pat Massey, Garrett Oil Tools, and C. M. Peters, Olsco Manufacturing Co.

● **Gaso Pump and Burner Manufacturing Company**
Tulsa, Oklahoma
Block W

Exhibit: Reciprocating piston power pumps, and complete pumping units.

Personnel: H. F. Stover, T. H. Flanagan, A. V. Simonson, H. A. Wienecke, Jr., A. L. Morrison, Ray L. Jaeger, W. L. Somner, H. G. Lawrence, D. I. Winters, J. A. McKinna, E. F. Keith, S. H. Yeager.

● **Gates Rubber Company, The**
Denver, Colorado
Texas Building, Booths 9 and 10

Exhibit: Super Vulco rope drives, industrial hose for petroleum industry, double-life pipe wiper, pipe line scrapers, long-life diaphragms for every pump service.

Personnel: Henry A. Page.

Tulsa address: 324 Archer Street.

● **Gatke Corporation**
Chicago, Illinois
California Building, Booths 23, 24, and 25

● **Gemco Oil Tools, Inc.**
St. Louis, Missouri
Oklahoma Building, Booth 19

● **General Electric Company**
Schenectady, New York
Oklahoma Building, Booths 241-244

Exhibit: First public showing of Type DP mechanical drive turbine. Electronically controlled motor-control center for refineries and processing plants. Other equipment will include starters of various types, control devices, portable welding equipment, various types of cable, a 3-hp Tri-Clad dripproof motor, a 25-hp mill motor, and an electro-hydraulic governing system used to control the speed of d-c motors. Also, an actual installation of a drilling rig with amplidyne bit control.

Personnel: C. A. Falkenau, H. A. White, E. C. Wise, R. Randall, H. C. Hill, J. N. Poore, M. M. Patterson, D. H. McAllister, H. T. Todd, K. M. Hemker, E. C. Clark, C. M. Sayomoen, J. E. Ham, R. G. Knaus, W. M. Anthony, T. E. Acord, A. E. Holland, I. T. Hockaday, W. A. Wirene, J. T. Farrel, R. D. Lesser, E. F. Patterson, W. F. Hilderbrand, and R. G. Smith.

● **General Industrial Supply Corp.**
Fort Worth, Texas
Silver Lane, Booth 29

● **General Motors Corporation**
Detroit, Michigan
Silver Lane, Block 10

Divisions of General Motors that will exhibit are: Chevrolet Motor, Cleveland Diesel Engine, Delco-Remy, Detroit Diesel Engine, General Motors Overseas Operations, GMC Truck and Coach, Harrison Radiator, Hyatt Bearing, and New Departure. These divisions are listed separately in directory.

● **General Motors Overseas Operations Division**
Detroit, Michigan
Silver Lane, Block 10

Exhibit: World map showing sales and service outlets overseas.

Personnel: E. E. Eby, I. C. Dresser, C. E. Cordes, August Krug, E. Burke, J. A. Kohner, R. L. Skidmore, and E. V. Stirbus.

● **Geolograph Company, Inc.**
Oklahoma City, Oklahoma
Scientific and Technical Building, Booth 49

Exhibit: Geolograph mechanical well logging.

Personnel: H. T. Brown, M. L. Jackson, Travis McMillon, and P. B. Nichols.

● **Geophoto Services**
Denver, Colorado
Oklahoma Building, Booth 162

● **Geophysical Development Corp.**
Tulsa, Oklahoma
Oklahoma Building, Booth 161

● **Geophysical Research Corporation**
Tulsa, Oklahoma
Scientific and Technical Building, Booth 51

Exhibit: Amerada type bottom hole recording pressure gauge and thermometer element.

Personnel: W. B. Kendall.

● **Geuder, Paeschke & Frey Company**
Milwaukee, Wisconsin
Silver Lane, Booth 30

● **Glasfloss, Inc.**
New York, New York
Block 102

● **Glass Engineering Laboratory**
Belmont, California
Scientific and Technical Building, Booth 79

● **GMC Truck & Coach Division, General Motors Corporation**
Pontiac, Michigan
Silver Lane, Block 10

Exhibit: Model FC-455, Model AC-805, and Model ADCW-979.

Personnel: Frank Doubet.

● **Goode Equipment Co., Inc.**
Houston, Texas
Texas Drive, Booth 5

● **Great Lakes Steel Corporation**
Detroit, Michigan
Block 107

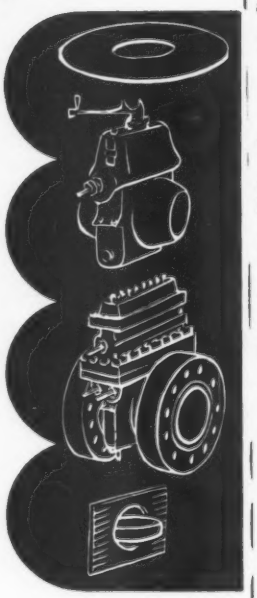
DANIEL First

1st Inexpensive Removable Wafer Plate

1st "Junior" Type Orifice Fitting

1st Hi-pressure "Senior" Orifice Fitting

1st Non-metalic "Dual-Seal"



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DANIEL introduces the SIMPLEX

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Socket Weld for field installation
Welding neck for shop fabrication
Inexpensive removable wafer plate
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INEXPENSIVE — SAVES TIME — LABOR — MONEY

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You asked for it...

HERE IT IS!

THE CLARK-IDECO

750 HP STEEL TRIPLEX

...now field-proved

See it at the TULSA OIL SHOW together with the improved steel 400 hp Triplex

CLARK STEEL *Triplex*

IDECO

ONE OF THE DRESSER INDUSTRIES

ALSO ON DISPLAY AT THE IDECO EXHIBIT:

PR-1350 POWER RIG—the 9-speed, all air-controlled rig for deep drilling.

PR-600 POWER RIG—the all air-controlled rig for medium depth drilling.

PR-150 POWER RIG—the rig designed for fast operation on shallow drilling.

RAMBLER RIG—the torque converter-driven rig for drilling and servicing. See the Rambler on the Hy-Lift Rams.

HYDRAULIC DRILLING RIG—completely operated by hydraulic power—for shot hole, coring and water well drilling.

No. 40 SPUDDER—the heavy-duty rig for cable tool operation.

PUMPING UNITS—A. P. I. models for light and heavy-duty service.

See these operating displays of drilling and servicing units at the Ideco exhibit.

INTERNATIONAL DERRICK & EQUIPMENT COMPANY

Sales Headquarters: **Dallas, Texas**

Export Offices: **Dallas, New York, Torrance**

Sales Offices, Stores and Distributors Everywhere

Ideco Equipment sold by: Republic Supply Company, Mid-Continent Supply Company, Howard Supply Company, Bovaird Supply Company, American Pipe & Supply Company, International Derrick and Equipment Company.

● **Greb X-Ray Company**
Kansas City, Missouri
Scientific and Technical Building, Booth 24
Exhibit: Picker X-Ray diffraction unit.
Personnel: Gordon G. Greb, Dewey N. Parker, and Frank R. Black.
Tulsa address: 563 North Waco. Phone: 2-3583.

● **Grove Regulator Company**
Oakland, California
Texas Building, Booths 36 and 37
Exhibit: Wing unions, combination adjustable nipple, drill pipe wipers, drill pipe protectors and installation equipment, steel core pistons, ball lock oil saver, and sleeve valve swab.
Personnel: J. H. Goode, J. H. Goode, Jr., Floyd C. Moberly.

● **Guiberson Corporation, The**
Dallas, Texas
Oklahoma Building, Booths 217, 218, 233, and 234
Exhibit: New rotating drilling head, kelly, tubing block, new swivel, packers, swabs, unions, tubing catchers, and gas-lift equipment.
Personnel: A. Pranger, S. T. Alton, R. A. Day, N. H. Anderson, and others.
Tulsa address: Hotel Tulsa.

● **Gustin-Bacon Manufacturing Co.**
Kansas City, Missouri
Silver Lane, Booths 25 and 26
Exhibit: Ansul-Dugas fire extinguishers, Rolagrip pipe couplings, Gruvagrip pipe couplings, Flexigrip tubing fittings, Expan-seal plungers for oil well pumps, G-B Blue Bonnet stuffingboxes
Personnel: C. H. Armstrong, P. O. Craig, D. W. Martin, H. M. Stone, and M. C. Beaver.
Tulsa address: 811 Thompson Building.

● **Hacker Machine & Supply Co.**
Henderson, Texas
Block 3

● **Haering & Co., Inc., D. W.**
Chicago, Illinois
Kansas Building, Booths 127 and 128
Exhibit: Chrom glucosates for corrosion control, phospho glucosates for scale control, sulpho glucosates for oxygen removal, In-Hib-Co protective coatings, organic chemicals for water conditioning, H-O-H feeders for accurate proportioning.
Personnel: V. W. Haering and E. H. Snyder.

● **Haines Company, C. C.**
Coffeyville, Kansas
Kansas Building, Booth 21

● **Halliburton Oil Well Cementing Co.**
Duncan, Oklahoma
Block K and East of Block K, on Arcade Way
Exhibit: Super-cementer truck, floating equipment, measuring devices, formation testing tools, squeeze packers both drillable and removable, electrical logging, caliper tools, side wall coring tools, gun perforating tools, acid and plastics, Roto wall cleaners, and casing centralizers
Personnel: Grover Kilgore and Walter Woods.
Tulsa address: 1403 Philtower Building. Phone: 4-3117.

● **Hamer Oil Tool Company**
Long Beach, California
Texas Building, Booths 102, 103, 108.
See Well Equipment Mfg. Corp.

● **Hammel-Dahl Company**
Providence, Rhode Island
Scientific and Technical Building, Booths 45, 46, 57, and 58
Exhibit: Microflo control valve, diaphragm control valve, supersensitive gas regulator, Venturiflo angle valve.
Personnel: E. T. Dahl, B. A. Irwin, J. R. Curran, and Otto Kneisel.

● **Happy Company, The**
Tulsa, Oklahoma
Block J and West of Block U
Exhibit: (Arcade Way): Pumping unit, beam switch, engine starter, belt tightener, belting, belt connections, belt dressing, belt cement, balls and seats, stuffingbox rubbers, valve cups, Ruscalo, litmus testers. (Block J): VAD-16 cooling unit, standard and master series cooling units, Vortox LB-50 air cleaner.
Personnel: Paul E. Mahaffey, Leo C. King, Roy C. Lindley, Rowdy Robson, J. Robert Meek, Orville L. Smith, Jack Simpson, W. H. Gorey, Wiley Swearengen, Charles Stanley, Ed Allan, Jimmie Allen, Bus Williams, G. H. Hopkins, H. J. Kinkade, Jon R. Long, Cotton Rundle, Ben Shelton, Charley Kitch, Bill McCracken, John Ritter, and Joe Royer.

● **Harley Sales Company**
Tulsa, Oklahoma
Block 4
Exhibit: Cutaway models of Wisconsin air-cooled heavy duty engines.
Personnel: A. H. Knief, George Kluppel, Bob Moog, Ray Fellows, Roy O. Neal, Joe Owens, and S. D. Bowles.

● **Harnischfeger Corporation**
Milwaukee, Wisconsin
Kansas Building, Booth 32, 33, 34, and 35

● **Harrisburg Sales & Service, Inc.**
Houston, Texas
Block 3

● **Harrison Radiator Division, General Motors Corporation**
Lockport, New York
Silver Lane, Block 10
Exhibit: Radiators, oil coolers, jacket water coolers, and various extended surfaces.
Personnel: F. H. Carter and H. W. Lloyd.

● **Haynes Stellite Company**
Kokomo, Indiana
See Union Carbide and Carbon Corporation

● **Hazard Wire Rope Division, American Chain & Cable Co.**
Wilkes-Barre, Pennsylvania
Texas Building, Booths 7 and 8
Exhibit: Lay-set preformed wire rope for rotary drilling lines; bailing, coring and swabbing lines; tubing and sucker rod lines; winch lines, and Nonparell non-preformed wire rope.
Personnel: H. S. Frady, J. R. McCrea, J. P. Time, R. C. Power, and B. N. Burns.

● **Heil Company**
Milwaukee, Wisconsin
Block 102

● **Heinn Company**
Milwaukee, Wisconsin
California Building, Booth 49
Exhibit: Folders and binders showing system of loose-leaf cataloging.
Personnel: Ralph B. White and W. H. Truax, Jr.
Tulsa address: Mayo Hotel.

● **Helicord Gage Division, American Chain & Cable Co.**
Bridgeport, Connecticut
Oklahoma Building, Booth 174
Exhibition: Pressure gages for oil field services.
Personnel: J. V. Tracy.

● **Hendershot Tool Company**
Oklahoma City, Oklahoma
Silver Lane, Booth 34
Exhibit: Midco slush pump valves and seats, patented clean out bailers, hydrostatic bailers, drag bits, process of resleeving rotary drill collars and tool joints.
Personnel: Herman B. Hendershot and Clark C. Wright.

● **Hercules Motors Corporation**
Canton, Ohio
Oklahoma Building, Booths 76, 77, 78, 133, 134, 135
Exhibit: Power units and engines.
Personnel: J. A. Lupfer.

● **Hercules Tool Company**
Tulsa, Oklahoma
California Building, Booths 7, 8, and 9
Exhibit: Tubing hangers, combination thread pumping and flowing tees, duplex polished-rod stuffingboxes, tubingheads with slips, tubingheads designed for use with Kobe pumps, Reda pumps and input wells, stripper tubingheads, casingheads with slips, casingheads (Louisiana pattern), tubing spiders, and other equipment.
Personnel: S. P. Tschappat, L. C. Rhoads, Dan E. Tschappat, R. J. Hewson, Clarence H. Copeland, and H. Callahan.

● **Hewitt Rubber Division, Hewitt-Robins, Incorporated**
Buffalo, New York
Block 3
Exhibit: Products will be shown by Mid Continent Supply Company.
Personnel: R. E. Crane, L. D. Bigelow, F. H. Dickinson, Webb Sowden, and Marion Austin.

● **Hilliard Corporation, The**
Elmira, New York
Oklahoma Building, Booth 153
Exhibit: Units for lubricating and fuel oil purifying.
Personnel: T. A. LaBrecque.
Tulsa address: c/o The Condit Company. Phone: 3-5746.

● **Hillman-Kelley**
Los Angeles, California
Silver Lane, Booths 18 and 19

● **Hinderliter Tool Company Division, H. K. Porter Company, Inc.**
Tulsa, Oklahoma
Block 5
See H. K. Porter Co.

● **Hobart Brothers**
Troy, Ohio
Kansas Building, Booths 10 to 16
Exhibit: Welding equipment.
Personnel: Clyde H. Minton, Robert C. Bercaw, Richard L. Sherwood, and E. K. Butterfield.

● **H & M Pipe Beveling Machine Co.**
Tulsa, Oklahoma
Kansas Building, Booths 129, 130 and 131
Troy, Ohio
Kansas Building, Booths 10 through 16
Exhibit: Arc welders, accessories, and electrodes.
Personnel: E. K. Butterfield, R. E. Bercaw, and R. L. Sherwood.

● **Hollup Corporation**
Chicago, Illinois
Oklahoma Building, Booths 95-98

● **Hopeman Equipment Company**
Seminole, Oklahoma
Oklahoma Building, Booth 88
Exhibit: Waukesha engines and parts, Twin Disc clutches and parts, torque converters, and hydraulic couplings, Edwards wire rope, Kohler electric light plants, and SKF roller bearings.
Personnel: John C. Burge, R. J. Caldwell, D. L. Adkins, Lloyd R. Hopeman, W. F. Denham, Lester A. Fishel, and Glenn Gibson.

● **Hough Manufacturing Company, Charles N.**
Franklin, Pennsylvania
Texas Building, Booths 123 and 124
Exhibit: Balls and seats, seamless steel, seamless bronze and chrome plated working barrels, working barrel valves, upper valves, oversize lower valves, plungers, packing rings, plunger pump, insert pump, polished rods, polished rod liners, stuffingboxes, lower valve pullers, rod couplings, tong bits, sucker rod sockets, ignition tubes, and adjusters.
Personnel: Charles N. Hough, Bert B. Wertman, Leroy L. Reib, Kelly S. Curry, Howard H. Francis, William J. Irwin, Martin J. Lowe, Jr., James L. Miller, and David E. Smith.
Tulsa address: Company office at 1-5 North Frankfort Street.

● **Hughes Tool Company**
Houston, Texas
Block 106
Exhibit: Tricone rock bits, Sedgrip and Fleshweld tool joints, and type J core bit.
Personnel: Gus Meyer, W. L. Hunter, R. L. Long, R. E. Kimsey, and W. H. Siems.
Address during Exposition: DeAnn Motel Courts, Claremore, Oklahoma.

● **Hutchison Engineering Works**
Houston, Texas
Kansas Building, Booths 79 and 80
Exhibit: "Rumba" shale shakers, and "Flolight" rig lighting sets.
Personnel: F. E. Hutchison and C. R. Curtis.
Tulsa address: Mayo Hotel.

● **Hyatt Bearing Division, General Motors Corporation**
Harrison, New Jersey
Silver Lane, Block 10
Exhibit: Roller bearings: "Hy-Load," "Industrial Inch," "Solid Junior Roller," "Spherangular," "Wound Roller."
Personnel: H. K. Porter, J. R. Gilmartin, J. L. Haynes, F. H. Webster, J. M. Kelly, R. W. Frazer, H. M. Carroll, J. A. Trail, C. L. Newby, L. S. Nagle, and L. L. Hill.

● **Hydraulics Division, Rockwell Manufacturing Company**
Pittsburgh, Pennsylvania
Scientific and Technical Building, Booths 33-38
Exhibit: See Rockwell Manufacturing Company.

● **Hydril Company**
Los Angeles, California
Block F, Booth 1
Exhibit: Blowout preventers, tubing stripper, tubing control assembly for stripping tubing, "Twinpin" and "Pressure weld" joints for drill pipe, casing joints, tubing joints for high pressure wells, inside blowout preventers, drill pipe float valves, retrievable plugs for drill pipe and tubing, plugs for casing, back pressure valves for drill pipe.
Personnel: Earl M. Daniels.
Tulsa address: 304 East 20th Street.

● **Hyster Company**
Peoria, Illinois
Block G
Exhibit: Hyster Karry Krane, "20" lift truck and "40" lift truck.
Personnel: Clarence E. Houston.
Tulsa address: Adams Hotel.

● **Independent-Eastern Torpedo Co.**
Fort Worth, Texas
Block L
Exhibit: Shooting trucks.
Personnel: W. M. McFarland.
Tulsa address: 619 E. Fourth Street.

● **Independent Supply Company**
Tulsa, Oklahoma
Kansas Building, Booths 32, 33, 34 and 35
Exhibit: Welding equipment including 200-amp gasoline driven arc welder.
Personnel: Harry Stallard and J. D. Turner.

● **Indian Drilling Mud Company, Inc.**
Britton, Oklahoma
California Building, Booth 42
Exhibit: All types of mud equipment.
Personnel: R. M. Ross, W. L. Potter, H. L. Smith, and W. C. Summy, Jr.
Tulsa address: Bliss Hotel.

● **Industrial Sales & Engineering Co.**
Houston, Texas
Kansas Building, Booths 43, 44, 45, 60, 61, 62, and 63
Exhibit: Drop and flat die forgings, gears, pumping units, and reducers, Greasl seals, leather and Sirvene products, laminated shims stock, An-cor-lox nuts, and tapered roller bearings.
Personnel: Willard R. Davis, L. B. Holt, L. H. Gay, H. L. Northup, S. E. Ullman, L. H. Schrade, John Holy, John Dowling, H. O. James, H. D. James, Richard Seipt, George C. McMullen, Ivan C. Mann, Roy C. Kropp, and J. E. Sweeney.
Tulsa address: 421 Mayo Building. Phone: 3-3610.

● **Industrial X-Ray Engineers.**
Tulsa, Oklahoma
Oklahoma Building, Booth 221
Exhibit: X-Ray machine to inspect pipe line welding.
Personnel: C. E. Boucher, Harold Hovland, and R. R. Hughes.

● **Ingersoll-Rand Company**
New York, New York
Block U
Exhibit: New development in gas-engine-driven gas compressors; refinery and pipe line pumps; portable air compressors and air tools; 4U electric impact tool, and J-10 Utility Jackhammer.
Personnel: Harry M. Fiske, J. J. Janzen, K. M. Har, F. J. Wetzel, F. W. Sultan, Jr., W. H. Lee, Neal Ham, L. H. Geyer, and George Brahler.
Tulsa address: Company office at 319 East Fifth Street.

● **Insley Manufacturing Company**
Indianapolis, Indiana
Block 9

● **International Cementers, Inc.**
Long Beach, California
Park Lane, Booth 24
Exhibit: PL-7 oil well cementing truck and auxiliary equipment; other cementing, pumping, and bulk cement equipment; bridging plugs, and cementing plugs.
Personnel: John D. Chesnut, Jack S. Smith, and E. P. Hollywood.

● **International Derrick and Equipment Company**
Dallas, Texas
Block 11
Exhibit: Power rigs, Rambler rig, hydraulic drilling rig, No. 40 spudder, drilling derricks, Triplex slush pump, hydro-rotary unit, 350-ton crown block, 350-ton traveling block, 300-ton swivel Hydrair hoist, pumping units.
Personnel: G. W. Walton, T. D. Collins, C. R. Athy, F. Barnes, M. J. Rampp, J. D. McEwen.
Tulsa address: 913 Kennedy Building. Phone: 3-6594.

● **International Equipment Co.**
Boston, Massachusetts
Scientific and Technical Building, Booth 79

● **International Harvester Company**
Chicago, Illinois
Block 101, Skelly Drive
Exhibit: Five diesel-powered crawler tractors, with matched equipment, three diesel power units, four carburetor type engine power units, and six trucks with matched equipment.
Personnel: Neal Higgins and W. K. Perkins.

● **International Nickel Co., Inc., The**
New York, New York
Texas Building, Booths 64 and 65
Exhibit: Background display illustrating flow sheet of oil industry showing uses of nickel alloys.
Personnel: H. S. Lewis, B. B. Morton, A. G. Zima, B. A. Weathers, R. J. Rice, F. R. Bailey, G. A. Fisher, and W. MacNaughton.
Tulsa address: Mayo Hotel.

● **Iverson Supply Company**
Tulsa, Oklahoma
Kansas Building, Booths 88, 89, and 90
Exhibit: Drilling, production, and refinery equipment.
Personnel: S. J. Iverson, A. M. Iverson, S. B. Iverson, H. M. Lundquist, C. E. Robertson, H. F. Oliver, Wayne Wallace, R. B. Yanaway, and M. A. Ashworth.

● **Jackson Products**
Warren, Michigan
Kansas Building, Booths 32, 33, 34, and 35

● **Jaeger Machine Co.**
Columbus, Ohio
California Building, Booths 4 and 5

● **James Manufacturing Co., D. O.**
Chicago, Illinois
Kansas Building, Booths 43, 44, 45, 60, 61, 62, and 63

● **Jarecki Manufacturing Company**
Erie, Pennsylvania, and Houston, Texas
Texas Building, Booths 87 and 88
Exhibit: Brass and iron valves, brass malleable and gray iron pipe fittings, pipe threading machines, oil and gas well supplies.
Personnel: Karl G. Wagner, H. A. Brightwell, and Fred T. Shaffer.
Tulsa address: Company office at 15 West First Street.

● **Jensen Bros. Mfg. Co.**
Coffeyville, Kansas
Kansas Building, Booth 21
Exhibit: Oil field pumping equipment and speed reducers (Geartorks).
Personnel: K. R. Jensen, W. G. Jensen, L. G. Fenn, and Bill Peycke.

● **Jerguson Gage & Valve Co.**
Somerville, Massachusetts
Scientific and Technical Building, Booth 86
Exhibit: Trulevel distant reading boiler water gauge, Reflex and transparent gauges and gauge valves.
Personnel: W. A. Griffin and James A. Ford.

● **Jim Ritchie Co.**
Tulsa, Oklahoma
Park Lane, Booth 16

● **Johns-Manville**
New York, New York
Oklahoma Building, Booths 44-47
Exhibit: Asbestos pipe line felts, corrugated transite roofing and siding, transite asbestos-cement pipe, Marinite for fireproofing structural steel, insulations and refractory products, and packing and gaskets.
Personnel: E. J. Liggett.
Tulsa address: Tulsa office at 1701 East Seventh Street.

● **Johnston Oil Field Service Corporation, M. O.**
Los Angeles, California, and Houston, Texas
Block 104-F
Exhibit: Formation tester, depth pressure recorders, tool joint refacer, "Shoot-N-Test" gun perforator, hydraulic equipment.
Personnel: M. O. Johnston, W. F. Bettis, and William Taylor.

● **Johnston & Jennings Company**
Cleveland, Ohio
Oklahoma Building, Booths 82 and 129
Exhibit: Tank equipment.
Personnel: C. J. Van Landeghem and William H. McGunagle.
Tulsa address: c/o Allan Edwards, Inc., 505 McBirney Building.

● **Jones Company, S. M.**
Tulsa, Oklahoma
Oklahoma Building, Booths 15 and 16
Exhibit: Miniature beam pumping installation.
Personnel: L. J. Pundt.

● **Jones & Laughlin Steel Barrel Co.**
Pittsburgh, Pennsylvania
Block 1
Exhibit: See Jones & Laughlin Steel Corporation.

● **Jones & Laughlin Steel Corporation**
Pittsburgh, Pennsylvania
Block 1, Jones & Laughlin Building
Exhibit: Joint exhibit with Jones & Laughlin Supply Company and Jones & Laughlin Steel Barrel Company. Tubular products—integral joint drill pipe, casing, shot hole casing, tubing, line pipe, cement lined pipe. Wire-rope products—rotary drilling lines, cable tool drilling lines, sand lines, casing lines, tubing lines, and winch lines. Steel barrels — oil drums, grease drums, and chemical drums.

Moving Ahead with SPARTAN

SEVERAL MONTHS AGO, you will recall our first ad "A New Standard of Service"—It contained a brief statement of policy and an outline of program over three personal signatures.

Today, the program is an expanding reality—150 men on the payroll with an aggregate experience of more than a thousand years in oil well cementing and testing—plus *new*, modern equipment with *new* standards of engineering.

The very first cementing unit set a *new* standard.

New?

Two high-powered engines, two torque converters, two high-pressure pumps, air operated controls—a new combination with the greater assurance of successful performance.

The two torque converters, used for the first time in any cementing unit, mean that there is no stoppage of the moving cement during a squeeze job in order to shift gears to get more power. Stoppage of the cement at this critical point may be the premature end of the job. Two high-powered engines and two high-pressure pumps, either one of which may be used for squeezing, means greater assurance of completing a job if one pump or one engine fails.

The first cementing unit of this type, designed for pressures up to six thousand pounds, was completed January 7th, went to the field, did fourteen jobs in the first eighteen days. We expected to bring it back for modification if any serious bugs developed, but now, 75 days later, it has passed its sixtieth job and is still going strong.

Eight cementing units (five power and three steam) are now in service out of the initially-planned fleet of fifty. New buildings are under construction at the main plant in which we will speed up production.

For pressures over 6000 pounds we are having special pumps built and expect the first delivery in April.

The bulk cement units embody new principles, being operated by two pounds of air pressure instead of by mechanical screws. The new advantages are simpler operation and if the air power in a bulk unit fails the air is supplied immediately from an auxiliary source. This double factor of safety has never been available before.

The Perfo-Tester was a highly developed tool when we took it over through purchase of the Hunt-Clark Co. and the Perfo-Test Co. We have made some refinements and are expanding its use, with 17 stations now operating.

We designed and built our open-hole formation tester and our squeeze tool and both made their initial runs in a well during March. Both runs were successful. These tools include some new features in design and are now in production.

Other tools and accessories are in various stages of design.

We are striving to accomplish our stated purpose of rendering "A New Standard of Service" and believe Spartan is not only moving ahead but is moving the cementing game ahead.

On behalf of the whole organization we appreciate the fine support and acceptance by the industry.

C. P. Parsons
H. F. (Blackie) Clark
Turner Briggs

SPARTAN TOOL & SERVICE CO.

Main Office • 2101 Esperson Building
Houston 2, Texas

Main Plant • 2101 Old Spanish Trail
Houston, Texas

SPARTAN SERVICE IS RESPONSIBLE SERVICE — ENGINEERED FOR THE NEEDS OF THE PETROLEUM INDUSTRY.

Spartan Cementer on the job with two bulk cement units.

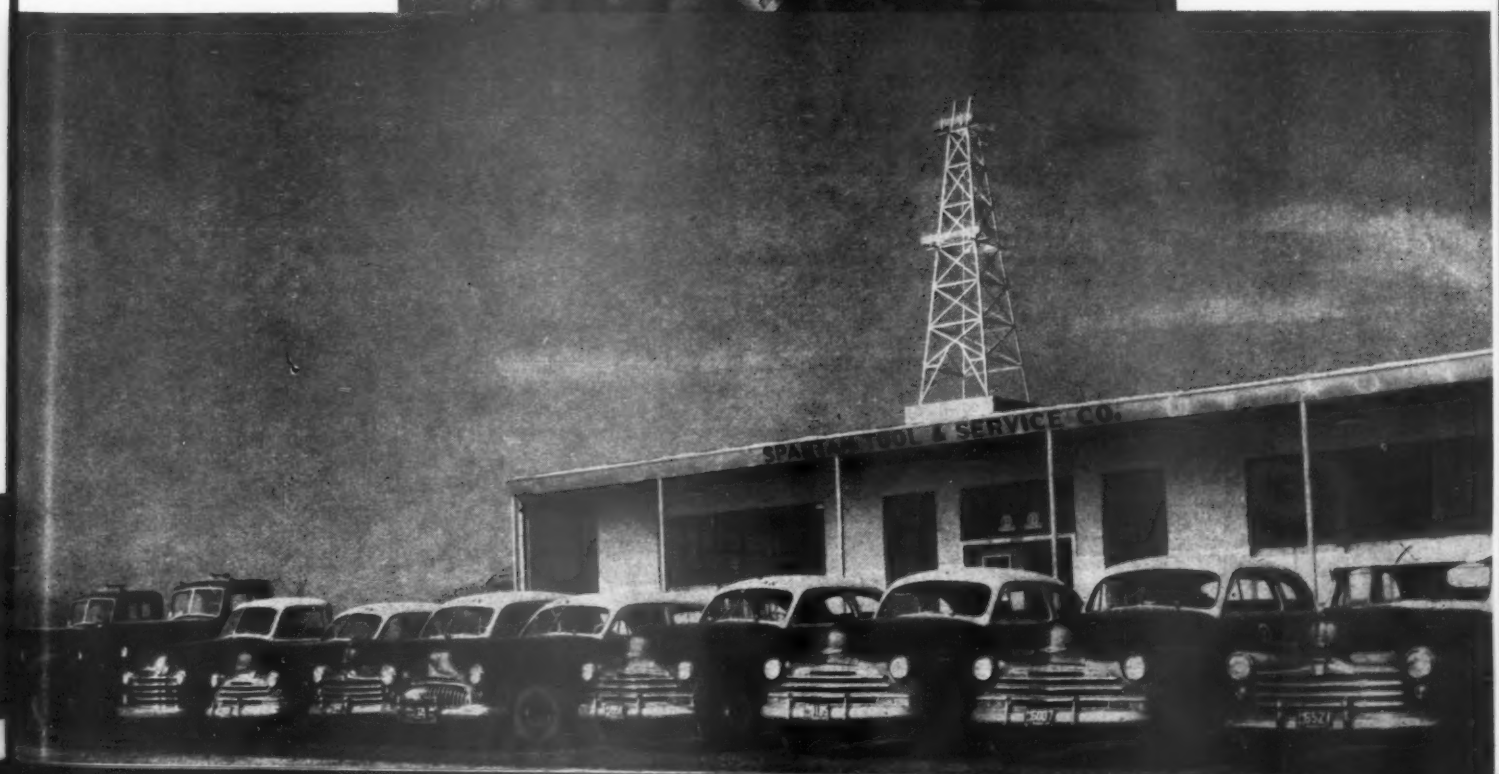
Assembling the first power driven cementer. Spartan rigs are Spartan designed and manufactured.

"Here Comes Spartan!" Field car, cementer and bulk unit on the move.

Installing pumps.

SPARTAN

Entrance to Spartan Tool & Service Company plant.



● **Jones & Laughlin Supply Company**
Tulsa, Oklahoma
Block 1, Jones & Laughlin Building
Exhibit: New Cabot pumping units; new design Wheland Company swivels, drilling crown, and traveling blocks, pumps and rotaries. New design Axelson Manufacturing Company depth well pumps.
Personnel: Robert McCoy, Jr.

● **Jones, Shelburne & McGuTey, Inc.**
Oklahoma City, Oklahoma
Park Lane, Booth 19
Exhibit: JSG "Spad" and "Super Spad" drilling rigs.
Personnel: K. C. Shelburne.

● **Joyce-Cridland Company**
Dayton, Ohio
Texas Building, Booth 49 and 50

● **Joy Manufacturing Company**
Pittsburgh, Pennsylvania
Block 7
Exhibit: New motorized drill rigs, portable air compressors, String-a-Lite assemblies for derricks, hoists, rock drills, and Joy Axivane fan.
Personnel: R. Forrest Rosenberger, A. S. Knoizen, E. M. Platts, O. J. Neslage, F. W. Harrison, R. E. Campbell, Edward Luce, L. Van da Griff, J. H. Emrick, B. P. Lane, J. A. Noyes, J. E. M. Schultz, R. T. Banks, W. T. Schedel, L. C. Rhodes, and K. A. Lehner.
Tulsa address: Hotel Tulsa.

● **Justrite Manufacturing Company**
Chicago, Illinois
Scientific and Technical Building, Booth 17

● **Kelley Company, Ben F.**
Tulsa, Oklahoma
Texas Drive, Block 3
Exhibit: Safety friction spinning and breakout catheads, and safety polished-rod clamps.
Personnel: W. L. Kelley and B. F. Kelley.
Tulsa address: 18 South Madison.

● **Kem-I-Kal Engineering Laboratories**
Centralia, Illinois
Park Lane, Booth 32
Exhibit: Oil field and industrial paints, Phostone Water Treet chemical for corrosion, chemical well cleaning compound, and paraffin solvent.
Personnel: Clarence L. Fetty, Willis B. Porter, and Miss Fay Collinsworth.

● **Kerotest Manufacturing Company**
Pittsburgh, Pennsylvania
Oklahoma Building, Booths 89, 90, 121, and 122
Exhibit: Full flow pipe line gate valves, redesigned lubricated flow line valves, stainless steel valves, patented Kerosphere ball valve, drilling valves, chokes, gate, globe, angle, and swing check valves for refinery service, needle valves, throttle valves, christmas tree, and LP-gas equipment.
Tulsa address: Mayo Hotel.

● **Keuffel and Esser Company**
Hoboken, New Jersey
Oklahoma Building, Booth 213
Exhibit: Drafting, reproduction and surveying equipment and materials, slide rules, and measuring tapes.
Personnel: H. E. Bowman, W. H. Bolter, and A. D. Tasker.

● **Kidde & Co., Walter**
Belleville, New Jersey
See Steve C. Maples & Co.

● **Kieley and Mueller, Inc.**
North Bergen, New Jersey
Kansas Building, Booths 81 and 82
Exhibit: Diaphragm valves, pressure pilots, and liquid level pilots.
Personnel: Joseph O'Connor, Clifford B. Ives, and Robert J. Donnelly.
Tulsa address: Stentz Equipment Company, 226 East 4th Street.

● **Kilian Manufacturing Corporation**
Syracuse, New York
Scientific and Technical Building, Booth 40

● **King Oil Tools**
Houston, Texas
Silver Lane, Booth 25
Exhibit: Medium, light and extra light drilling swivels, circulating heads for wire line coring, wire line strippers (line wipers) for coring, wire line strippers (oil savers) for swabbing, and dynamite loading tools for seismograph crews.
Personnel: W. E. King.

● **Kinley Company, M. M.**
Houston, Texas
Silver Lane
Exhibit: Tubing calipers, tubing perforator, sand line cutting gun, releasing rope socket, and weight indicator for measuring line.
Personnel: Myron Kinley and Jack Kinley.

● **Kobe, Incorporated**
Huntington Park, California
Block 11
Exhibit: Full-scale and operating demonstration installation of the Kobe Free Pumping System.
Tulsa address: 335 Kennedy Building. Phone: 2-3153.

● **Koebel Diamond Tool Company**
Detroit, Michigan
Oklahoma Building, Booth 260
Exhibit: Diamond Core bits.
Personnel: Charles J. Koebel and Robert E. Todd.

● **Koppers Company, Inc.**
Pittsburgh, Pennsylvania
Texas Building, Booths 73, 74, and 75
Exhibit: Four divisions of Koppers Company, Inc., will have exhibits. The Piston Ring Division will have a large display of industrial piston rings of the type widely used in the petroleum industry. The Shops Division will exhibit Fast's self-aligning couplings. Pressure treated wood for marine piling and as structural timber will be exhibited by the Koppers' Wood Preserving Division. The exhibit of the Koppers Tar Products Division will feature Bituplastic, the protective coating that will not "alligator."

● **Korkele Production Engineering Co.**
Wichita Falls, Texas
Silver Lane, Booth 39
Exhibit: Submerged oil and gas separator, adjustable stroke control for oil wells, and close clearance oil well pump.
Personnel: Mr. and Mrs. Kork Kelley, Patricia Kelley White, Kathryn Kelley, Robert Kork Kelley, and Alfred L. White.

● **Kropp Forge Company**
Chicago, Illinois
Kansas Building, Booths 44, 45, 60, 61
Exhibit: Forgings for the oil industry.
Personnel: Roy A. Kropp, Raymond B. Kropp, James E. Sweeney, R. T. O'Keefe, Jr., C. F. Johnson, Victor Brown, B. H. Gebhardt, L. Ruchti, C. H. Lestina, and Warren Hoglund.

● **Ladish Company**
Cudahy, Wisconsin
Kansas Building, Booths 7, 8, and 9
Exhibit: Seamless welding fittings, forged-steel screwed and socket welding fittings, forged-steel flanges in carbon, stainless, and alloy steels, drop forgings, seamless reducing elbow, 20-in. taper designed full branch outlet tee, Ladish stainless, alloy steel and non-ferrous fittings.
Personnel: J. F. Hacker, R. M. Foltz, W. F. Gardner, W. O. Kupper, H. L. Pehrson, J. D. Best, G. E. Mahoney, R. C. Foltz, M. S. Kachigan.
Tulsa address: Mayo Hotel.

● **Laminated Shim Co., Inc.**
Glennbrook, Connecticut
Kansas Building, Booths 43, 44, 45, and 60

● **Landry, Inc., Max E.**
Tulsa, Oklahoma
Block G
Exhibit: Power generating and transmitting machinery.
Personnel: D. D. McBeth, B. W. Charlton, Ed. Rawlins, of Bruce-McBeth Engine Company; Max E. Landry, M. Debrey, Simplex Company.

● **Lane-Wells Company**
Los Angeles, California
Block V
Exhibit: Service trucks, incorporating new developments in gun perforating and radioactivity well-logging service, packers, formation testing tools, radioactivity well logging instruments, bridging plugs, and gun perforators.
Personnel: Jas. D. Hughes, John J. Neale, R. B. Downing, C. F. Ludwig, Claude Kirkman, J. W. McPhee, and J. Murray Walker.

● **Larkin Packer Company, Inc.**
St. Louis, Missouri
Oklahoma Building, Booths 51 and 52
Exhibit: Float equipment, Cementrol equipment, casing centralizers, tubingheads, casingheads, swage nipples, and bull plugs.
Personnel: W. H. Larkin, J. J. Larkin, Jr., and T. E. Alexander.
Tulsa address: 41 South Elwood.

● **Lauson Engine Company**
New Holstein, Wisconsin
Park Lane, Booth 20

● **Lebus Company, F. L.**
Longview, Texas
Texas Drive, Booth 8

● **Leeds & Northrup Company**
Philadelphia, Pennsylvania
Scientific and Technical Building, Booths 29 and 30
Exhibit: Pneumatic control, both round-chart and strip-chart models; multiple-point temperature recorders, Micromax and Speedomax high-speed multiple-point temperature indicator; portable glass-electrode pH indicator, and portable temperature indicator.
Personnel: A. E. Tarr, G. C. Graf, M. E. Griffith, E. B. Estabrook, R. E. Hansen, D. S. Lansdon, J. W. Stockard, J. L. Serrill, and E. R. Fiske.
Tulsa address: Company office at 4th and Main Streets.

● **Le Roi Company**
Milwaukee, Wisconsin
Block R
Exhibit: L3460 engine, H540 engine, A288 engine, model D226 engine, model D140 cutaway engine, complete set of rock drills, model Tractair, combination air compressor and tractor, distribution maps, service parts layout, and generator set.
Personnel: R. M. Darr, L. G. Valdes.
Tulsa address: 302 North Cincinnati Street.

● **Leschen & Sons Rope Company, A.**
St. Louis, Missouri
Texas Building, Booths 31 and 32
Exhibit: Wire rope for oil field purposes, including drilling lines, tubing lines, sand lines, and winch lines, in both preformed and non-preformed types.
Personnel: L. E. Dressler, L. W. Weyler, C. H. Watson, J. C. Hoffman, and C. M. Holland.

● **Liggett Supply and Equipment Co.**
E. Monongahela, Pennsylvania
Silver Lane, Booth 31

● **Lincoln Electric Company, The**
Cleveland, Ohio
Oklahoma Building, Booths 201, 202, 249, and 250
Exhibit: Semi-automatic welder using "Hidden arc" process, A-C transformer welders, new line of light weight air-cooled engine-driven welders.
Personnel: A. F. Davis, R. H. Looney, and James Dawson.
Tulsa address: Company office at 2750 Sand Spring Road.

● **Linde Air Products Company**
New York, New York
Oklahoma Building, Booths 237, 238
See Union Carbide and Carbon Corporation.

● **Line Scale Company, Inc.**
Oklahoma City, Oklahoma
Oklahoma Building, Booths 205 and 206
Exhibit: Line scales, stratagraph recorders, automatic recorders, pressure gauge, electric crane scales, and polio exerciser.
Personnel: J. C. Conrad, Mr. and Mrs. P. Z. Conrad,and W. E. Farr.
Tulsa address: Hotel Bliss.

● **Link-Belt Company**
Chicago, Illinois
Texas Building, Booths 61, 62, 63
Exhibit: Link-Belt shale shakers with an NRM-124 mud screen set up for operation; rotary-drilling drive chain, roller chain and silent chain; ball and roller bearings in mounted and unmounted types; dual hook-up mud screens.
Personnel: George Howson, Stuart Penick, John Yetter, William Brinkworth, James Samuell, Thornton Hughes, Charles Winters, Frank Blake, Charles Weiss, Al Fellinger, Orvin Gaskins, Russell Sweeney, Jerrus Bryant, George Woody, Art Maha, and Byron Hartman.

● **Long, Jon R.**
Fort Worth, Texas
Block J and West of Block U
Exhibit: See The Happy Company.

● **Louis Allis Company, The**
Milwaukee, Wisconsin
Kansas Building, Booths 48 and 49
Exhibit: Explosion-proof motors, splash-proof motors, Adjusto-Spedes (variable A-C drive).
Personnel: Louis Allis, Jr., K. H. Boehmer, John W. Elder, and C. G. Skidmore.
Tulsa address: 310 Thompson Building.

● **Lovejoy Flexible Coupling Company**
Chicago, Illinois
California Building, Booth 27

● **Lovelace Manufacturing Company**
Tulsa, Oklahoma
Block 107
Exhibit: Shooting truck, dynamite trailer, cap box, engineer car, loading poles, stadia rod, and field furniture.
Personnel: Marion W. Loveless, W. P. Loveless, and J. E. Reinhardt.
Tulsa address: 1726 East Oklahoma Street.

● **Lubrikup Company, Inc.**
Williamsport, Pennsylvania
Oklahoma Building, Booth 184
Exhibit: Fluid seal rod packing, Wood-type valve cups, JerkerKups, seating cups, and hydraulic jack cups.
Personnel: W. M. Connor, W. P. Wood, M. L. Frazier, and R. L. Mitchell.
Tulsa address: The Wells Hotel.

● **Ludlow Valve Mfg. Co., Inc.**
Troy, New York
Block 3
See Mid-Continent Supply Company.

● **Lufkin Foundry and Machine Co.**
Lufkin, Texas
Block 3
Exhibit: Seven pumping unit assemblies, GSC and GSDH gas engines, GSDH engine generator set, oil field type float trailer, models 15 and 30 truck winches, model 125 tractor winch, and N128 geared speed increaser.
Personnel: L. A. Little, D. A. Reid, Byron Robbins, Newell Lynch, Cooper Richards, Elvin Read, Charles Dyer, W. H. Miner, Edd Terrill, Ed Caraway, Linville Caraway, Tom Crowder, and Moulton Harrison.

● **Lufkin Rule Company, The**
Saginaw, Michigan
Texas Building, Booths 121 and 122
Exhibit: Precision tools, measuring tapes, and rules.
Personnel: E. H. Meibeyer, R. M. Benjamin, C. E. Brown, F. H. Jordan, Jr., B. D. Earnst, and W. F. Rockwell.
Tulsa address: Tulsa Hotel.

● **Lukens Steel Company**
Coatesville, Pennsylvania
Oklahoma Building, Booth 195
Exhibit: Clad Steel, Clad Steel welding sequence panel, specimen plates of Clad Steels, twist and tensile test specimens, and Clad Steel head.
Personnel: G. M. Gillen, William J. Powers, Charles W. Ripple, and Franklin M. Beltrando.

● **Lunkenheimer Company, The**
Cincinnati, Ohio
Oklahoma Building, Booth 67 and 68
Exhibit: A complete line of bronze, iron, steel, and corrosion-resistant valves, boiler mountings, air devices, lubricating devices, cocks, whistles, etc. New products include line of 125-lb S. P. bronze globe, angle, and check valves; recently developed lines of 125, 150 and 200-lb bronze gate valves; bronze globe and angle valves with 500 Brinell type stainless steel plug seats and disks.
Personnel: H. E. Lunken, H. A. Burdorf, H. H. Layritz, J. A. Birkhead, D. R. Davis, S. H. Hill, C. B. Rosser, Jr., M. N Stickel, E. R. Tieberman, Jos. Waldeck, F. H. Hehemann, and Wm. Brinkman.

● **Mack-International Motor Truck Corporation**
New York, New York
Block 104
Exhibit: LMSW-M six-wheel, off-highway oil field model truck, EH 2-axle oil field model truck, and axle type Power Divider.
Personnel: H. Rowold, M. C. Horine, R. J. Meinert, J. A. Briggs, and R. W. Allen.
Tulsa address: Mayo Hotel.

● **Macwhyte Company**
Kenosha, Wisconsin
Oklahoma Building, Booths 130, 131
Exhibit: Wire rope for rotary and cable tool drilling. Stainless steel wire rope. Monel Metal wire rope, "Safe-Lock" swaged cable assemblies. Braided wire rope slings. Wire rope for all equipment needs.
Personnel: F. J. Nelson, J. A. Long, R. P. Tyler, H. M. Robinson, D. E. Wood, and R. E. Sawyer.

● **Madden Company, P. E.**
Chicago, Illinois
Scientific and Technical Building, Booth 86

● **Magnaflux Corporation**
Dallas, Texas
Silver Lane, Booth 11
Exhibit: KRH-2 Magniflux unit, XB-2A Magnaflux powder blower, Magnaglo, Zyglo, and Stresscoat.
Personnel: George L. C. Dehn, and R. O. Schiebel, Jr.
Tulsa address: 110 Midco Building, % Marshall Travis.

● **Magneto Ignition Co., Inc.**
Tulsa, Oklahoma
Kansas Building, Booths 129, 130, and 131

● **MagniLastic**
Chicago, Illinois
Kansas Building, Booth 17
Exhibit: Packless expansion joints.
Personnel: R. T. Mathias.
Tulsa address: Mayo Hotel.

● **Magnus Chemical Company**
Garwood, New Jersey
Texas Building, Booth 46
Exhibit: Chemical cleaning compounds and Magnus Aja-Dip cleaning machine.
Personnel: Thomas O'Brien and W. E O'Meilia.
Tulsa address: Phone: 7236.

● **Mall Tool Company**
Chicago, Illinois
Silver Lane, Booth 38
Exhibit: Gasoline engine, air and electrically operated chain saws; portable electric saws and drills; concrete vibrators with attachments; and flexible shaft grinders and sanders.
Personnel: Frank Fisher, James Hardman, and R. W. Proctor.

● **Maloney-Crawford Tank and Manufacturing Company**
Tulsa, Oklahoma
Texas Building, Booths 116 and 117
Exhibit: Horizontal heater-treater.
Personnel: S. A. Wilson, E. E. Storey, and T. J. Costello.

● **Manco Manufacturing Company**
Bradley, Illinois
Park Lane, Booth 22

● **Manning, Maxwell & Moore, Inc.**
Bridgeport, Connecticut
Oklahoma Building, Booth 230

● **Manzel, Inc.**
Buffalo, New York
Oklahoma Building, Booth 50
Exhibit: Gas motor and lubricators.
Personnel: H. H. Roosa, W. C. Jackson, George Dorscheid, Frank Esch, Paul Condit, and Robert Meyers.
Tulsa address: W. C. Jackson, 1723 East 13th Place.

● **Maples & Company, Steve C.**
Tulsa, Oklahoma
Scientific and Technical Building, Booths 5 and 6
Exhibit: Jari power scythe; Quigley Company (refractories and insulating materials); Quigley Panel Construction Co. (refractory panels); Kidde fire extinguishers; Sarco traps and strainers; Manzel lubricators and feeders; Miracle adhesives; Wheeling expanded metal; Helicoid gages; Reilly tar products.
Personnel: Robert A. Moore, Forrest H. Hickman, L. R. Cutler, Steve C. Maples.

● **Marley Company, Inc., The**
Kansas City, Missouri
Kansas Building, Booth 78
Exhibit: Scaled model double-flow cooling tower.
Personnel: Roy W. Maze and L. A. Christensen.
Tulsa address: 709 McBirney Building. Process Equipment Company.

● **Marlin Rockwell Corporation**
Jamestown, New Jersey
Scientific and Technical Building, Booth 40

● **Marlow Pumps**
Ridgewood, New Jersey
Kansas Building, Booths 86 and 87
Exhibit: Marlow self-priming centrifugal pumps and mud hog diaphragm and plunger pumps.
Personnel: A. S. Marlow, Jr., Andy Rubin, Vincent Vandervoort, A. C. Stratton, Jim Jordan, Kirk Shivell, Dick Denekamp, and C. Lupton.
Tulsa address: Stentz Equipment Company, 226 East Fourth Street.

● **Marman Products Company, Inc.**
Inglewood, California
Silver Lane, Booths 8 and 9
Exhibit: Pipe leak clamps, special clamps, and universal hose clamps.
Personnel: G. A. Mahoff and G. C. Adams.

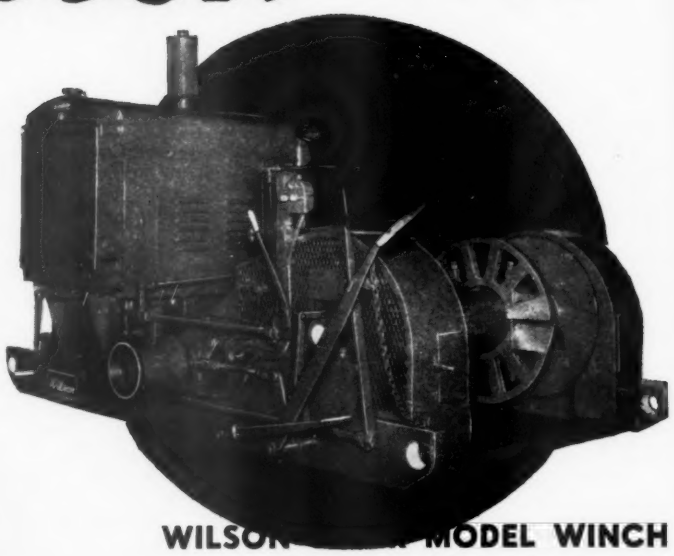
● **Marmon-Herrington Company, Inc.**
Indianapolis, Indiana
Block W
Exhibit: New All-Wheel-Drive trucks, All-Wheel-Drive converted Fords.

● **Marshall Supply & Equipment Co.**
Tulsa, Oklahoma
Kansas Building, Booths 95 and 96
Exhibit: Welding equipment, shovels and steel goods, tools and wrenches, electric tools, tools and cutters, tool bits and tips, carborundum abrasives and grinding wheels, motors, C-O-two fire equipment, twist drills and cutters, vises, wrenches and pliers, saws, bearings and transmission equipment, taps and dies, valves, rules and tapes, files, brushes,

ENGINEERED TO DO A BETTER

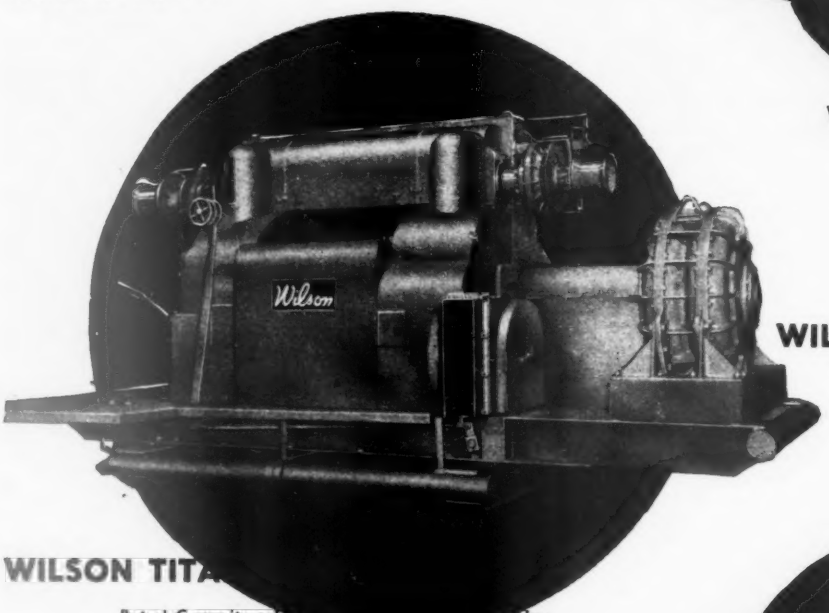
Wilson RIGS

The Wilson nameplate means fewer parts that wear, fewer adjustments to make, longer life, increased safety. Wilson has a Coupling Type Clutch on pump drives with no measurable wear when disengaged . . . no pulley bearings to wear out . . . a flexible coupling that's proven best! Wilson has an automatic Free Wheeling Clutch on hydromatic brake to eliminate shock on drum drive. Wilson has an automatic air compressor clutch—the friction element wears up to ¼"! Never needs adjustment! Wilson has a water pump specially designed for oil field service with self-adjusting packing . . . extra large shaft on precision ball bearings. See these rigs and winches. See why the men who use 'em *like 'em!*



WILSON [illegible] MODEL WINCH

Recommended for wells 3,500 to 5,000 feet. 2½" tubing. Semi-steel, machined brake rings . . . alloy steel, double heat treated shafts, accurately ground to size . . . free rolling jaw clutch drums. Jaw or friction clutches optional. Air-Tube Clutch can be furnished.



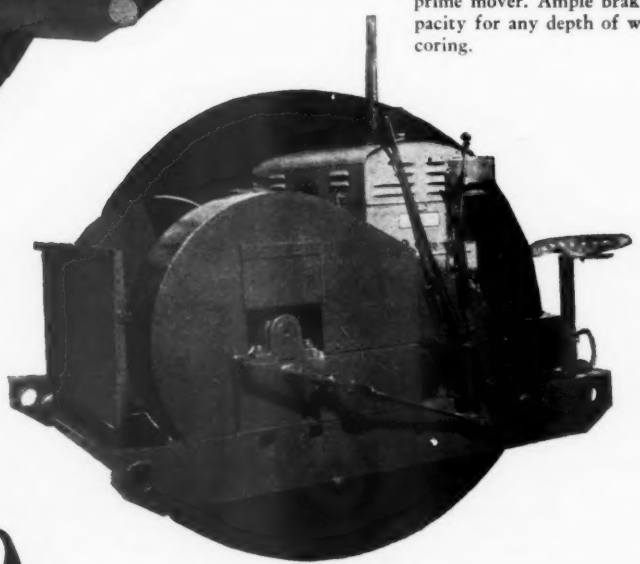
WILSON TITA[illegible]

Rated Capacity—12,[illegible] pipe or 15,000 ft., using 3½" drill pipe

A record-holding power rig with amazingly low operating costs on wells of 10,000 feet and over. In many instances, Wilson Titans have exceeded their rated capacity without undue stress or strain on any working part!

WILSON MOGUL MODEL CORE REEL

Model shown below has spooling capacity of 12,000 feet of ⅝" wire rope or 15,000 feet of 9/16" wire rope. Furnished with gas-gasoline, butane, or diesel prime mover. Ample braking capacity for any depth of wire line coring.

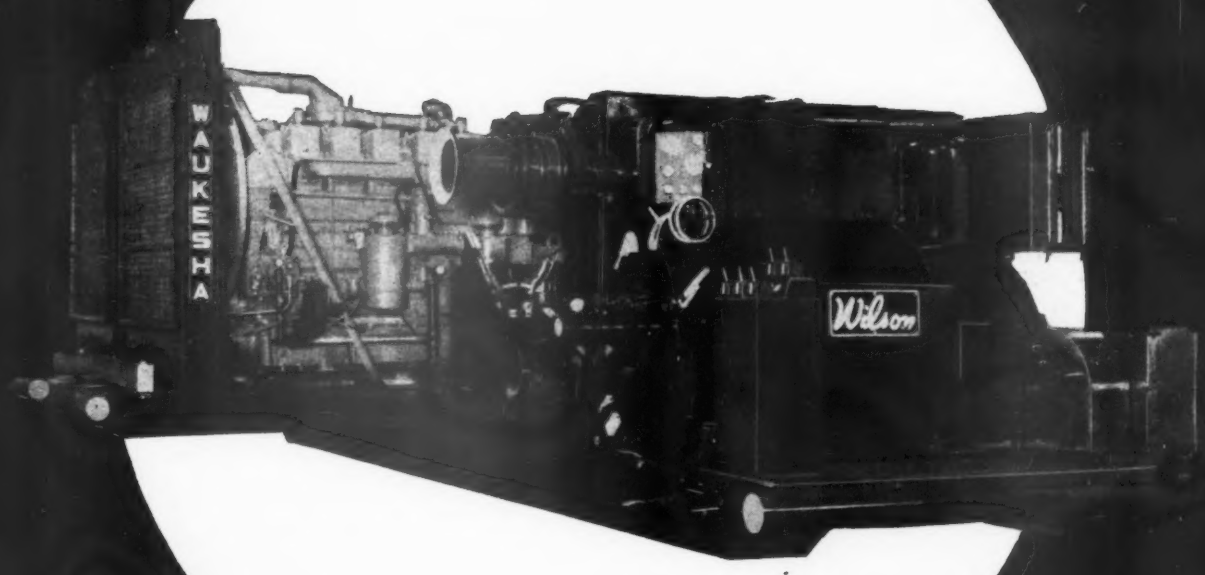


Wilson

MANUFACTURING CO., Inc.

WICHITA FALLS, TEXAS

See us at the International Oil Exposition
BLOCKS "R" and "N"
Tulsa-May 15-22



SON GIANT MODEL POWE

Rated Capacity—7,500 ft., usi
or 9,000 ft.

sary Giant offers unequall

EXPORT REPRESENTATIVE • GUY E. DANIELS • 30 ROCKEFELLER PLAZA • NEW YORK CITY
PACIFIC COAST DISTRIBUTOR • POWER RIG & EQUIPMENT CO. • LOS ANGELES, CALIFORNIA

pipe machines, sockets, fire extinguishers, precision measuring tools, saw blades, and pipe threading devices.

Personnel: W. P. Marshall, Jr., Fred C. Robbins, Alan L. Curtis, Fred R. Dibert, George I. Wingo, E. T. Rohrkaste, Orville G. Frantz, Jr., Harry R. Pritchett, and Joe H. Dibert.

● **Martin-Decker Corporation**
Long Beach California
Block 4

Exhibit: Weight indicators, Sealtite drilling control instrument, Drillogger, automatic rate of penetration recorder, pump dynamometer, high-pressure check valves, hydraulic 25,000-lb pressure booster, and utility model pulsation damper.

Personnel: E. L. Decker, E. M. Donovan, and Jack Clemens.

Tulsa address: Tulsa Hotel.

● **Martin, John N., Manufacturer**
Tulsa, Oklahoma
Oklahoma Building, Booth 41

Exhibit: Martin plungers (oil well pump); Martin cages (oil well pump).

Personnel: John N. Martin, E. W. Brockman, Tom Hulett.

Tulsa address: Martin and Hulett, Alvin Hotel; Brockman, 1244 South Quincy.

● **Martin Supply Company**
Tulsa, Oklahoma
Park Lane, Booth 36

● **Maxim Silencer Co.**
Hartford, Connecticut
Blocks 6, 7, 8

● **Mayhew Machine & Supply Company**
Dallas, Texas
Block 107 and SE of Cafeteria

Exhibit: Three portable exploration drills and portable drill supplies and accessory equipment.

Personnel: Harry M. Pigman.

Tulsa address: Mayo Hotel.

● **McCord Corporation**
Detroit, Michigan
Oklahoma Building, Booths 72 and 73

Exhibit: Force feed mechanical lubricators, chemical pumps, gaskets, and unit heaters.

Personnel: Ralph Urso, Al Moon, Harry Shank, and Edwin O. Bodkin.

● **McCullough Tool Company**
Los Angeles, California
California Building, Booths 17 and 18

Exhibit: Magna-Tector, surface recorder and pressure bomb, gun perforators, jet cutter, gun tester, electronic weight indicator, mechanical firing assemblies, electrical firing top assembly with sonic device, burrless bullets, deflecting bullets, complete electric service unit, collar finder, external drill pipe cutter, mechanical long knife casing cutter, double-acting rotary jar, rotary releasing spear, and rotary releasing socket.

Personnel: O. J. McCullough, I. J. McCullough, W. C. Erwin, C. A. Marion, D. J. Hall, Bob Smith, Ralph Lesseig, and Jack Wiley.

● **McDonald Company, B. F.**
Los Angeles, California
Texas Building, Booth 54

Exhibit: Personal safety equipment, combustible gas indicators, and first aid kits.

Personnel: B. F. McDonald, J. J. Delahide, E. S. Stanzel, and M. J. Brown.

Tulsa address: Bliss Hotel.

● **McEvoy Company**
Houston, Texas
Park Lane, Booths 27 and 28

Exhibit: Wellhead equipment, gate valve, and gas lift valve.

Personnel: Lawrence Wood and B. Fritz Krause.

Tulsa address: Mayo Hotel.

● **McGill Manufacturing Company**
Valparaiso, Indiana
California Building, Booths 42 and 43

● **McKissick Products Corporation**
Tulsa, Oklahoma
Oklahoma Building, Booths 245 and 246

Exhibit: New 69-in traveling block and snatch blocks.

● **Medart Company, The**
St. Louis, Missouri
Block J and West of Block U

Exhibit: See The Happy Company.

● **Meriam Instrument Company**
Cleveland, Ohio
Scientific and Technical Building, Booth 27

● **Metal Goods Corporation**
St. Louis, Missouri
Kansas Building, Booth 132

● **Mid-Continent Airlines, Inc.**
Tulsa, Oklahoma
North side of office building

Exhibit: Mid-Continent Airlines route map and Pan American route map.

Personnel: Glen Antrim and George A. Stevens.

Tulsa address: 112 East Fifth Street.

● **Mid-Continent Petroleum Corporation**
Tulsa, Oklahoma
Kansas Building, Booth 19

Exhibit: Color photographic transparencies, murals, etc.

● **Mid-Continent Supply Company**
Fort Worth, Texas
Block 3

Exhibit: Inside building: A.C.F. valves; American Chain & Cable Company wire rope; Bethlehem sucker rods; Barbour Stockwell panel board; Construction Machinery Company pumps; Fawick Airflex clutches; Evans Thermo-Controlled fans; Hewitt Rubber Company easel display on hose; Harrisburg liners; Hinderliter Tool Company tubinghead and tool joint; Igloo Manufacturing Company water cooler; Larkin Parker Company float shoes, casing centralier, tubinghead; Baker Oil Tools float shoes, casing centralizer; Ludlow valves; Naylor pipe and coupling; petroleum solvents; W. C. Norris Manufacturer, tubinghead and stuffingbox; Tube Turns welded pipe parts; Wahlberg McCreary air starters; Mid-Continent circulating unit, and relief valves.

Outside: Lee Moore derrick and substructure; 10-in. Cameron Dual ORC 10,000 psi test blowout prevention hookup on top Rigon 6000 psi test blowout preventer; Emsco pumps; Westinghouse air compressor; 25-hp General Electric Thyrite; U-30 Unit Rig; American cathead; Foster cathead; Mid-Continent Cummins multiple engine rig and pump drive; 27½-in. Ideco rotary table; Baasch Ross roller kelly drive bushing; 104-in. six-sheave Rigon traveling block; EH7 Rigon crown block with catline sheave; American Trulay wire rope; 4-300 Bryon Jackson hook; Type MGG 4½-in. elevator; Type B tongs; Hewitt rotary hose; Chiksan rotary hose; Byron Jackson power slips; Link-Belt shale shaker; Mid-Continent 5-ft step-up type substructure; Mid-continent engine house, and safety guards; 5x10 Gardner Denver pump underneath substructure; Halliburton measuring device; Sheppard diesel light plant; Emsco DD-80 unit pumper with Sheppard diesel operating on crude oil; Emsco DC-38 with electric motor; D-12 Emsco pump with NHPS Cummins diesel engine equipped with Fawick Airflex clutches; Reed Roller Bit Company drill collars; Allis Chalmers, V-belt and sheaves on pump drives; American Iron and Machine kelly, and National Tube Company with flash weld Hughes tool joint.

Personnel: Representing Mid-Continent Supply Company: K. W. Davis, D. H. Thornbury, F. John, M. F. Cribbs, R. O. Moore, T. M. Cone, H. D. Powell, V. LeMay, S. R. Billingsley, J. P. Schwartz, C. D. Helm, D. S. Smith, J. L. Peeler, H. E. Martin, J. L. Waltrip, J. A. Embry, J. A. Daugherty, W. I. West, F. J. Spurlock, R. M. Flippo, J. W. Hoover, P. Z. Hilliard, G. A. Wead, S. R. Clinkscales, G. B. Blair, E. C. Schafer, R. L. Moyer, Nick Carter, J. P. Alexander, G. W. Walters, J. H. Kenyon, C. M. Fleeman, T. P. Tarwater, A. T. Skaer, G. L. Huestis, R. L. McAnally, G. A. Dow, Dale Fuller, J. F. Rone, C. J. Kelly, N. W. Dail, M. C. Shaw, and L. A. Pyeatt.

Representing Cummins Sales & Service, Inc.: J. E. Everroad, C. V. Guinn, J. T. Calnon, P. H. Daily, E. F. Davis, D. L. Johnston, R. O. West, H. H. Hope, L. R. Marshall, H. E. Quinn, R. E. Ruth, J. H. Bradley.

Representing Mid-Continent Cummins Export: R. E. Elmore, E. G. Ellis, R. A. Hayes, T. N. Shults, G. A. Young, W. H. Parker.

Representing Harrisburg Sales & Service, Inc.: J. E. Snoddy, H. N. Landgrave.

Representing Aeroquip Sales & Engineering: Byron Snow, R. G. Fox, C. D. Hawthorne.

● **Midwest Piping and Supply Co., Inc.**
St. Louis, Missouri
Jones & Laughlin Building, Block 1

Exhibit: Fabricated header assembly.

Personnel: J. L. Jacobsen, E. A. Kerbey, S. T. Seeley, A. J. Ramsey, P. R. Becker, L. H. Niebling, W. F. Krahn, W. D. Cleghorn, S. G. Ramsey, L. K. Johnson, and W. A. Palm.

Tulsa address: 1233 South Canton.

● **Midwest X-Ray and Supply Co.**
Tulsa, Oklahoma
Scientific and Technical Building, Booth 24

Exhibit: Picker-Waite X-Ray diffraction unit.

Personnel: Mrs. Dewey M. Parker, Dewey M. Parker, and Frank Black.

● **Milton Roy Company**
Philadelphia, Pennsylvania
Kansas Building, Booths 23 and 24

Exhibit: Chemical and high pressure pumps, for refinery, natural gas, and pipe line applications.

● **Milwhite Company, Inc., The**
Houston, Texas
Park Lane, Booth 13

Exhibit: Kembreak—breakover chemical.

Personnel: Henry Davis, Ed Cadena, Jerry Cunningham, F. A. Frank, Jr., Robert C. Bieri, J. T. Hancock, Jr., Bob Jung, and Mr Mallory.

● **Mine Safety Appliances Company**
Pittsburgh, Pennsylvania
Oklahoma Building. Booths 48 and 49

Exhibiting: Combustible gas analyzer, carbon monoxide tester, oxygen mask, hose masks, protective hats, safety belts, benzol indicator, hydrogen sulphide detector, first aid materials, and snake bite kits.

Personnel: H. W. Richards, W. H. Gates, G. J. Gruber, J. W. Meehan, J. B. Davies, G. L. Seth, and N. W. Hartz.

Tulsa address: 119 West 8th Street.

● **Miniature Precision Bearings, Inc.**
Keene, New Hampshire
Scientific and Technical Building, Booth 40

● **Minneapolis-Moline Power Implement Company**
Minneapolis, Minnesota
East of Scientific and Technical Building

Exhibit: Oil field power unit.

Personnel: E. A. Henry, W. E. Swanson, E. R. Raveling, F. N. Langham, and W. D. Barry

Tulsa address: Tulsa Hotel.

● **Miracle Adhesives Corporation**
New York, New York
See Steve C. Maples & Co.

● **Mission Manufacturing Company**
Houston, Texas
Texas Building, Booths 91, 92, 93, 118, 119, and 120

Exhibit: Slush pump valves, pistons, rods, gland packing, rotary slips, power-operated rotary slips, swabs, plug valves, and centrifugal pump.

Personnel: W. T. Campbell, W. C. Under

Announcing

a new Combination . . .

An unusually simple and efficient Dead Line Anchoring Device in combination with a Weight Indicator of revolutionary accuracy, sensitivity and convenience.

MARTIN-DECKER

TYPE D

WEIGHT INDICATOR

National

IDEAL

TYPE D

WIRE LINE ANCHOR

THE NATIONAL SUPPLY COMPANY—MARTIN-D

wood, F. S. Mims, J. H. Barmister, Calvin O. Bell, Jr., Wm. F. Bennett, R. W. Chapman, C. W. Fryar, A. E. Higginbotham, J. E. Nolen, Jr., D. J. Ollre, A. R. Parker, L. I Roberson, L. M. Roberson, O. K. Ryan, C. L. Turner, J. E. Young, M. C. Davis, Cecil Cardinal, Jeff Tucker, and C. R. Summers.

Tulsa address: 1350 East 27th Place.

- **Mixing Equipment Company**
  Rochester, New York
  California Building, Booth 4

Exhibit: Complete line of mixing equipment for petroleum industry.

- **Modern Engineering Company**
  St. Louis, Missouri
  Kansas Building, Booths 32, 33, 34, and 35
- **Moore Company, W. D.**
  Tulsa, Oklahoma
  Park Lane, Booth 23
- **Moore Company**
  Kansas City, Missouri
  Scientific and Technical Building, Booth 3

Exhibit: A 13-ft diam monel metal cooling tower fan, 7-ft diam direct-drive monel metal cooling tower fan, 42-in. diam monel metal ventilating fan, and 36-in. diam monel metal pressure blower.

Personnel: Robert D. Moore, and Whitney M. Kerr.

Tulsa address: Adams Hotel.

- **Moore Corporation, Lee C.**
  Pittsburgh, Pennsylvania, and Tulsa, Oklahoma
  Oklahoma Building, Booths 65 and 66

Exhibit: Derricks, drilling masts, and automatic well servicing mast.

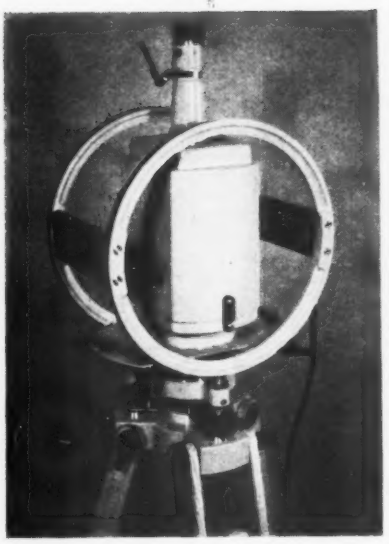
Personnel: H. J. Woolslayer and O. H. Dittmer.

RESEARCH INSTRUMENTS

for Geophysics
Magnetic Surveying Instruments
Vertical and Horizontal Magnetometers
for visual observation and recording.

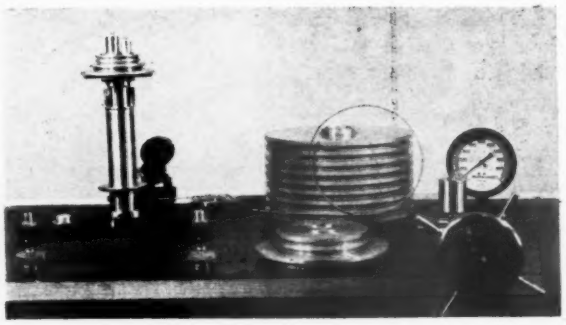
for Production
Core Analysis
Bottom Hole Sampling
Oil and Gas Analysis
Reservoir Engineering

for Refining
High Pressure and High Temperature Laboratory Equipment
Catalytic Reactor Systems
Proportioning Pumps
Dead Weight Gauges



Horizontal Magnetometer

For further information call or write to—



Dead Weight Gauge

RUSKA INSTRUMENT CORPORATION

4607 Montrose Blvd. **Houston 6, Texas**

- **Moorlane Company**
  Tulsa, Oklahoma
  Block U

Exhibit: Pipe line strainers, mist extractors, meter run, flow straightening vanes, orifice flanges and plates, flange bolting, special pipe fabrications, valves, expansion joints, furnace return bends, packing, weldolets and tank flanges, forged-steel unions, plug valve lubricants and guns, Zip-Lift hoist, gaskets, firebrick and refractory specialties, non-ferrous tubes, welding fittings and flanges, forged-steel valves and fittings, swivel joints, high speed chain hoist, traps, and strainers.

Personnel: Moorlane Company: Wm. D. Moorer, C. W. Harrington, Rex Bircket, H. K. Abernethy. Henry Vogt Machine Company: W. A. Jackman.

- **Moran Furnace & Sheet Metal Co.**
  Tulsa, Oklahoma
  East of Kansas Building
- **Morris Coupling and Clamp Co.**
  Ellwood City, Pennsylvania
  Park Lane, Booth 12

Exhibit: Couplings and clamps.

Personnel: H. D. Nicklin.

- **Morrison Brothers Company**
  Dubuque, Iowa
  California Building, Booth 58
- **Morse Chain Company**
  Detroit, Michigan
  Silver Lane, Booths 15 and 16

Exhibit: Silent chain rocker joint, roller chain drives, silent chain drives, coupling driveshafts, friction clutches, and indexing clutches.

Personnel: F. M. Hawley, R. J. Howison, D. C. McNeely, H. R. Greenley, and I. A. Horton.

- **Multi-Metal Wire Cloth Co., Inc.**
  New York, New York
  Kansas Building, Booths 30 and 31

Exhibiting: Fabricated wire and filter cloth units made especially for the petroleum industry.

Personnel: Lloyd M. Hopkins, Alfred Stern, Joseph Wilker, Nicholas Gaug, and Philip Broad.

- **Murdock Tank and Mfg. Co.**
  Tulsa, Oklahoma
  Northeast of California Building

Exhibiting: Emulsion flow type treater, oil and gas separator with dual control, thermo type heaters.

Personnel: F. L. Murdock and Jack Johnson.

- **Murphy Diesel Company**
  Milwaukee, Wisconsin
  Block A
- **Murphy, Frank W.**
  Tulsa, Oklahoma
  California Building, Booth 26

Exhibit: Water temperature and lube oil pressure safety switches for magneto and battery ignition power units, high and low pressure and vacuum controls and switches for pipe line pumps.

Personnel: R. W. Bagby, L. M. Carlton, F. W. Murphy.

- **Murray Rubber Company**
  Houston, Texas
  Oklahoma Building, Booth 16
- **Murray Tool & Supply Company**
  Oklahoma City, Oklahoma
  Oklahoma Building, Booths 63 and 64

Exhibit: Murkin water softener and Cassman shaft seals.

Personnel: John King, William Coopman, Jack A. Becker.

Tulsa address: Bliss Hotel.

- **Nash Engineering Company**
  South Norwalk, Connecticut
  Kansas Building, Booths 39, 40, 65, and 66

Exhibit: Air compressors, two-stage vacuum

That's what the Delta Drilling Co., Evansville, Indiana, says about "Caterpillar" Diesel Engines.

For over a year, two "Caterpillar" Diesel D17000 Engines have worked 24 hours a day, 25 days a month, powering the draw works and Wilson Snyder mud pump on a Delta job near Henderson, Kentucky.

Says the owner, "There's just no comparison between them and the power plants they replaced." And other operators, all over the world, say the same thing about these dependable engines.

Steady operation at low maintenance cost means efficient, profitable drilling. "Caterpillar" Diesel Engines are built to work long and hard, day in, day out—under the toughest conditions. Their performance is backed by dealer service long recognized as "the best in the business."

CATERPILLAR TRACTOR CO., PEORIA, ILLINOIS

GOING TO TULSA? Visit the "Caterpillar" Exhibit at the National Petroleum Exposition, May 15-22.

*

CATERPILLAR

REG. U. S. PAT. OFF.

DIESEL ENGINES • TRACTORS
MOTOR GRADERS
EARTHMOVING EQUIPMENT

pumps, and centrifugal pumps of "Pyrex" glass.

Tulsa address: 10 East 4th Street Building, W. C. Myers & Company.

● **Natasco Company, The**
Tulsa, Oklahoma
Scientific and Technical Building, Booths 69 and 70

Exhibit: Protective coatings, miniature oil storage tanks, showing application of Natasco coatings.

Personnel: R. E. Clark and D. L. Korn.

● **National Bank of Tulsa**
Tulsa, Oklahoma
Block H

● **National Carbide Corporation**
New York, New York
Oklahoma Building, Booth 30

● **National Cylinder Gas Company**
Memphis, Tennessee
Oklahoma Building, Booths 95, 96, 97, and 98

● **National Foam System, Inc.**
Philadelphia, Pennsylvania
Kansas Building, Booth 38

● **National Lead Co.**
St. Louis, Missouri
Scientific and Technical Building, Booth 50

● **National Supply Company**
Pittsburgh, Pennsylvania
Drake Drive, Block 1

Exhibit: Complete lines of drilling and producing machinery in operation; pumping units, the largest and smallest drilling rigs in their line both of which are new developments, the new Ideal Type 160 Consolidated rig for 16,000-ft drilling, Type-E 700 power slush pump, new heavy duty line of derrick equipment, high pressure wellhead equipment, working molel of Ideal Plunger Lift with Cycle Controller for producing deep wells by their own energy, pump parts, tubular products, drill collars, sucker rods, institutional exhibit emphasizing manufacturing and distribution facilities of company, Spang-Chalfant's new double seal shrink thread drill pipe and tool joints, Spang special purpose plastic coated drill pipe and tubing, Ideal drill collars and kellys, and Ideal slush pump and parts.

Personnel: M. E. Swaim, G. B. Cushing, R. D. Stottlemyer, H. E. Heywood, Jr., J. Adcock, G. C. Markley, C. B. Carter, Jr., E. C. Carter, R. A. Heckel, R. J. Donaghoe, E. M. Winans, O. O. Taylor, R. E. Bell, C. P. Jenkins, A. L. Harrington, L. A. Harris, J. D. Stewart, H. W. Hanners, C. T. Reichert, R. C. Allan, Jr., E. G. Blaisdell, W. T. Cushing, Jr., L. H. Daniel, Jr., W. C. Moody, E. L. Harder, J. F. Tucker, Jr., A. E. Finch, D. G. Knox, C. R. Spencer, W. H. Bennett, K. O. Hoevel, D. C. Neely, A. L. Wiegand, B. E. Curran, C. L. Bainter, C. Swartsfager, N. B. Biggerstaff, L. S. Ousterhout, J. C. Woods, J. B. Stephens, N. E. Allen, M. D. Munder, R. L. Dailey, A. M. Miller, F. D. Graves, K. J. Digel.

● **National Tank Company**
Tulsa, Oklahoma
Block S

Exhibit: Oil-water emulsion treaters, oil and gas separators, lease storage tanks, heaters, dehydrator, and combination hookups of these items.

Personnel: C. O. Glasgow.

Tulsa address: National Tank Company.

● **National Technical Laboratories**
South Pasedena, California
Scientific and Technical Building, Booth 79

Exhibit: Quartz spectrophotometer, flame spectrophotometer, portable pH meters, radiation meters, and new model H-2 AC-operated pH meter.

Personnel: T. F. Herring.

● **Naylor Pipe Company**
Chicago, Illinois
Block 3, Mid-Continent Supply Co. Building

Exhibit: Lock-seam spiralweld surface casing, lock-seam spiralweld line pipe, heavy duty wedgelock coupling.

● **Neilson Pump Division, Oil Well Supply Company**
Long Beach, California
Block 2
See Oil Well Supply Co.

● **Nelson Electric Manufacturing Co.**
Tulsa, Oklahoma
Oklahoma Building, Booth 168

Exhibit: Instrument panel, generator control panel, oil field motor starters, explosion-proof motor starters, explosion-proof circuit breakers, miscellaneous equipment including control stations, time delay push button stations, and insulated pipe line flanges.

Personnel: H. A. Norberg, Dick Ray, Reeves Terhune, Tom Feurt, and Curtis Oakes.

● **New Bedford Cordage Co.**
New York, New York
Blocks 6, 7, 8

● **New Deal Specialty Co., Inc.**
Okmulgee, Oklahoma
Block 107

Exhibit: Casing spiders, casing elevators, tubing spiders, tubing elevators, deep well deadline anchor clamps, wire line drilling clamps, pipe cleaning machines, hydraulic pipe straighteners.

Personnel: Ben Colchensky, J. D. Roberts, G. T. Bynum, and M. R. Pinkerton.

Tulsa address: Phone: 5-1488.

● **New Departure Division, General Motors Corporation**
Bristol, Connecticut
Silver Lane, Block 10

Exhibit: Heavy duty single row and double row bearings, as well as sealed, shielded, and snap ring ball bearings; also small jewel type ball bearings used by instrument makers. The well known New Departure ball bouncing machine will again be on display. A small model forging machine in operation will be a feature.

Personnel: Frank J. Miller, LeRoy A. Hillman, H. Wm. Pochyla, Aubrey E. Bishop, and Carleton B. Beckwith.

Tulsa address: Mayo Hotel.

● **Nice Ball Bearing Co.**
Nicetown, Pennsylvania
Scientific and Technical Building, Booth 40

● **Nordberg Manufacturing Company**
Milwaukee, Wisconsin
Silver Lane, Booth 24

Exhibit: Diesel engines.

Personnel: A. S. Telfer and H. M. Cahill.

● **Nordstrom Valve Division, Rockwell Manufacturing Company**
Pittsburgh, Pennsylvania
Scientific and Technical Building, Booths 33-38

Exhibit: See Rockwell Manufacturing Company.

● **Norma-Hoffmann Bearings Corp.**
Stamford, Connecticut
Texas Building, Booth 728

Exhibit: Ball, roller, and thrust bearings.

Personnel: R. L. Miller, W. S. Sargent, and G. W. Tompkins.

● **Norris, W. C., Manufacturer, Inc.**
Tulsa, Oklahoma
Block X

Exhibit: Hydraulic pumpers, working barrels, flow beans, stuffingboxes, roller rod line carriers, wrist pins and wrist pin connections, sub tubing couplings, polished-rod couplings, sucker rod couplings, bradenheads, tubingheads, underpull pumping jacks, adaptor nipples, boiler nipples, casing nipples, swaged nipples, tubing nipples, bull plugs, welding reducers, caps, drill rod, polished rods, sucker rods, pull rods, rod line swings, miscellaneous pumping equipment, turnbuckles, working barrel valves, balls and seats, valve pullers, and sucker rod wrenches.

Personnel: G. W. Davidson, J. W. Bowen, P. J. Donnelley, C. T. Fair, J. A. Getty, Jr., J. E. Giles, D. P. Hagaman, A. A. Hardy, R. V. Manis, Jr., Arthur Miller, Jr., Marvin L. Parker, Jack C. Schaff, C. B. Schofield, C. L. Snelling, Cliff Teel, and W. C. Tolleson.

● **Nugent & Company, Wm. W., Inc.**
Chicago, Illinois
Oklahoma Building, Booths 171 and 172

Exhibit: Pressure type oil filters, lubrication devices, sight feed valves, and sight flow indicators.

Personnel: John Vocelka, F. Lee Townsend, and Dallas Deem.

● **Oakite Products, Inc.**
New York, New York
Texas Building, Booths 22 and 23

Exhibit: Vapor cleaning unit, solution-lifting steam gun, interior tank cleaning unit.

Personnel: V. Bowes, V. L. Baltzell, S. C. Shank, J. R. Whyte, S. F. Hagler, R. Ham, L. W. Cunningham, H. T. Hancock, and T. C. Zimmerman.

Tulsa address: Bliss Hotel and Hotel Mayo.

● **O'Bannon Co., Walter**
Tulsa, Oklahoma
Texas Building, Booths 104 and 105

Exhibit: Rod type and tubing type oil well pumps and parts, oil well pump accessories, sucker rod sockets, rod hooks, rod and small tubing elevators, tubing tongs, tubing spiders, "S" links, polished-rod clamps, and polished rod tops.

Personnel: Walter O'Bannon, Jr., and Leslie E. Bates, Jr.

Tulsa address: Company office at 400 S. Rockford.

● **Ohio Injector Company**
Wadsworth, Ohio
Oklahoma Building, Booths 219, 220, 231 and 232

Exhibit: Cast steel pipe line valves, cast steel valves, forged steel valves, stainless steel valves, iron valves, and bronze valves.

Personnel: Wayne Young, P. M. Arnall, E. A. Young, Howard G. Doster, W. G. Shepard, W. C. Davis, M. W. Pauly, A. A. Kruse, Paul E. Banks, and E. G. Blaylock.

Tulsa address: Mayo Hotel.

● **Ohio Steel Foundry Company**
Springfield, Ohio
Texas Building, Booths 78 and 79

Exhibit: Assembled return bends and alloy tube supports; several special fittings used in refinery service.

Personnel: T. H. Harvey, J. D. Hagans, J G. Palmer, I. D. Cline, W. K. Rider.

● **Oil Center Tool Company**
Houston, Texas
Oklahoma Building, Booths 11 and 12

Exhibit: JE flow control, C-19 casinghead, T-16 OU tubinghead, WA-4 tubing hanger, P-142 proration choke insert, corrosion resistant gauge protector.

Personnel: J. H. Moran, J. E. Edwards, Fritz Richard, J. E. Eckel, C. B. Wright, and O. F. Jolly.

Tulsa address: Tulsa Hotel.

● **Oil Well Supply Company**
Dallas, Texas
Block 2

Exhibit: No. 96 drawworks with No. 1000 triple engine drive; No. 220-P power slush pump with No. 500-GM power drive; RT-21W rotary drilling unit; No. 330-D oilbath swivel; No. 100-C swivel; No. 64-B drawworks with No. 500 dual engine drive; No. 128-A portable derrick; 17½-A oilbath rotary; 5-in. by 11-in. stroke 2-stage gas booster unit; No. 46-P Triplex plunger power pump; No. 6P-HD Duplex power pump; TC-23, TC-12C, TC-8B, and TC-5C twin-crack pumping units; Lorain Type L engine; Witte models B and C horizontal

gas-gasoline engines, and Witte oil field light plant.

Personnel: M. F. Hazel, K. B. Winstead, R. L. Armstrong, Mark Barkhurst, Wm. Heldmar, R. R. McAfee, M. E. Nicklin, W. F. Parker, P. H. Shepherd, and V. J. Waters.

Tulsa address: Oil Well Supply Company, 405 Kennedy Building.

● **Okadee Company**
Chicago, Illinois
Texas Building, Booths 102, 103, and 108

● **Oklahoma Rig and Supply Company**
Muskogee, Oklahoma
Oklahoma Building, Booth 4

Exhibit: Hickory tool handles; wirebound containers.

Personnel: S. D. Slaughter.

● **Oklahoma Steel Castings Company, Inc.**
Tulsa, Oklahoma
Texas Building, Booths 47 and 48

● **Oliver United Filters, Inc.**
New York, New York
Park Lane, Booth 4

Exhibit: Charts and photographs showing applications of various Oliver United filters in the refinery and petro-chemical plant.

Personnel: G. E. Shaw, T. G. Laney, and J. K. Blakeley.

● **Olsco Manufacturing Company**
Longview, Texas
See Garrett Oil Tools.

● **Onan and Sons, D. W., Inc.**
Minneapolis, Minnesota
Block T

Exhibit: Electric generating plants-gasoline driven; electric generating plants-diesel driven; air-cooled gasoline engines, and marine air-cooled gasoline engines.

Personnel: Tony Middleton and Larry Lockhart.

Tulsa address: % Buda Engine Sales and Service.

● **Orbit Valve Company**
Tulsa, Oklahoma
Texas Building, Booths 33, 34, and 35

Exhibit: Drilling valves, forged steel flow line valves (oil country rating), and forged steel intermediate temperature valves (refinery rating).

Personnel: J. "Dock" Mumford, R. G. Cole, Henry Sawyer, L. E. Wallace, Dell Taylor, Jack H. Hancock, Claude Brown, Gerald G. Lowe, and Frank L. Bohan.

● **Oster Manufacturing Co.**
Cleveland, Ohio
Oklahoma Building, Booth 240

Exhibit: Underground pipe wrap; industrial insulation for high temperature installations, boilers, breechings, stacks, duct work, pipe covering; insulation for oil tank cars; insulation for electric motors, transformers, cables and wiring; building insulation; roofing insulation; non-combustible fabrics and drapery material, and Fiberglas coated cloth.

Personnel: C. L. Rowley, G. O. Hartzell, J. F. Ball, J. L. Neal, C. C. Callaway, Jr., H. S. Neipp, Ben S. Wright, Myron Leidy, and R. E. Trumbull.

● **Otis Pressure Control, Inc.**
Dallas, Texas
Silver Lane, Booths 6 and 7

Exhibit: Safety valve (actual demonstration), removable tubing safety valves, removable bottom-hole regulators, removable bottom-hole chokes, tubing closing and testing tools, removable side door chokes, removable pack-off anchors, tubing perforators and tubing cutters, wire line tools and equipment, tubing calipers, and two-zone pumps.

Personnel: H. C. Otis, I. A. Miller, H. C. Laird, L. M. Wilhoit, Harry B. Schramm, Turner Garwood, H. D. Johnston, Curtis Kizer, Temple P. Hoffer, and Don Taylor.

Tulsa address: 602 East Young Street.

● **Owens-Corning Fiberglas Corp.**
Toledo, Ohio
Kansas Building, Booths 97, 98, 119, 120, 121, 122

Exhibit: Fiberglas underground pipe wrap and Fiberglas industrial insulation materials.

Personnel: C. L. Rowley and G. O. Hartzel.

Tulsa address: Company office at 613-14 Palace Building. Phone: 4-3517.

● **Pacific Pumps, Inc.**
Huntington Park, California
Block 11

Exhibit: Pacific will introduce their new Type F pipe line pump. In addition, cutaway models showing construction details of the Pacific Type SVC centrifugal process pump and the Type WY centrifugal vertical pump will be on display. A working model of a Pacific oil well plunger pump will also be a feature of the exhibit.

Personnel: A. R. Weis, E. J. Weis, Roy Dunbar, M. F. Ecker, F. P. Applegate, A. F. Canada, Jr., and W. R. Carlson.

● **Pacific Pumps, Inc., Mid-Continent Division**
Tulsa, Oklahoma
Block 11

Exhibit: Oil well pumps.

Personnel: Roy A. Dunbar, Ralph C. Van Matre, D. E. Harder, G. F. Graham, Oris Orton, L. W. Yarberry, and C. C. Miller.

● **Page Oil Tools, Inc.**
Long Beach, California
Texas Building, Booth 13

Exhibit: Tubing anchors, tubing drains, sucker rod on and off attachments, bottom hole oil and gas separators, rotating bottom hole packers, and pump anchors.

Personnel: James E. Lady, John S. Page, Jr., and John S. Page.

● **Palmer Thermometers, Inc.**
Cincinnati, Ohio
Scientific and Technical Building, Booths 60 and 61

Exhibit: Red-Reading Mercury, industrial indicating and laboratory style thermometers mercury actuated, dial and recording thermometer instruments.

Personnel: Douglas H. Hitt and Frank W. Probst.

● **Paris, Henry H., Distributor**
Houston, Texas
California Building, Booths 20, 21, and 22

● **Parkersburg Rig and Reel Company**
Parkersburg, West Virginia
Block 8

Exhibit: New pneumatic pumper, new 40-in. double rotor hydromatic brake, new emulsion treater, prefabricated building, and chain-driven pumper.

Personnel: C. B. Morton.

Tulsa address: Company office Thompson Building.

● **Patterson-Ballagh, Division of Byron Jackson Company**
Los Angeles, California
Oklahoma Building, Booths 22-27

Exhibit: Crown block bumpers, swivel bail bumpers, traveling block bumpers, stand pipe clamp, pipe wiper cutter, mud guns, pipe lifter, derrick floor mats, mud gun nozzles, mud gun platform, casing protectors, thread protectors, protector remover tools, dead line stabilizer refills, kelly wiper refills, stand pipe clamp refills, swivel bail bumper refills, traveling block bumper refills, wire line guide refills, wire line wiper refills, dead line stabilizers, drill pipe stabilizers, deep well swabs, drill pipe wipers, wire line wiper, sucker rod protectors, tubing plastic protectors, and sucker rod wipers.

Personnel: J. C. Ballagh, J. B. Merritt, and J. P. Magoffin.

Tulsa address: Hotel Tulsa.

● **Peerless Manufacturing Company**
Dallas, Texas
Oklahoma Building, Booth 216

Exhibit: Mist extractor unit, automatic trap, meter type odorizer, and automatic engine cut-off.

Personnel: E. O. Haltom, R. B. Owens, T. M. Jarmon, Jr., Frank Norris, Ed. Warren, and Mrs. Mary H. White.

● **Perrault Brothers**
Tulsa, Oklahoma
Block 102

Exhibit: Coating and wrapping machines, cleaning and priming machines, tar heating kettles, pipe bending machines, glass pipe wrap, felt padding, and other equipment and supplies.

Personnel: Lewis Perrault and R. E. Shackelford.

● **Petro-Chem Development Company**
New York, New York
Block 9

Exhibit: Petro-Chem iso-flow furnace.

Personnel: Mr. Leech.

● **Petroleum Engineering, Inc.**
Houston, Texas
Oklahoma Building, Booth 222

Exhibit: Photographs, advertising, and other descriptive literature pertaining to natural gasoline plants, cycling plants, and appurtenant equipment.

Personnel: Paul M. Raigorodsky, W. A. Stover, and Edwin Norman.

● **Petroleum Engineer Pub. Co., The**
Dallas, Texas
Block 2

Personnel: W. L. Love, W. T. Bryan, K. C. Sclater, T. J. Crowley, E. V. Perkins, Joe B. Woods, Frank Love, Marshall Fagin, Floyd J. Morgan, Richard Sneddon, Bill Hunt.

● **Petroleum Equipment, Inc.**
Tulsa, Oklahoma
Scientific and Technical Building, Booth 80

Exhibit: Showing no exhibits; offering lounge facilities in booth.

Personnel: J. Howard Kinslow and C. Lewis Mims.

● **Petroleum Solvents Company**
New York, New York
Block 3

● **Pfaudler Company, The**
Rochester, New York
Kansas Building, Booths 52 and 53

Exhibit: High-speed vacuum can filling machine, and a 500-gal glass-lined reactor built for a pressure of 151 psi.

Personnel: G. F. Kroha, P. S. Barnes, C. M. Clark, W. D. Pheteplace, Alan Herrick, F. B. Morris, and B. E. Albair.

● **Phillips Petroleum Company, Chemical Products Department**
Bartlesville, Oklahoma
Oklahoma Building, Booths 151 and 152

Exhibit: Replica of a Perco catalytic desulphurization unit.

● **Pittsburgh Equitable Meter Division, Rockwell Manufacturing Co.**
Pittsburgh, Pennsylvania
Scientific and Technical Building, Booths 33-38

Exhibit: See Rockwell Manufacturing Company.

● **Pittsburgh Steel Company**
Pittsburgh, Pennsylvania
Texas Building, Booths 4, 5, and 6

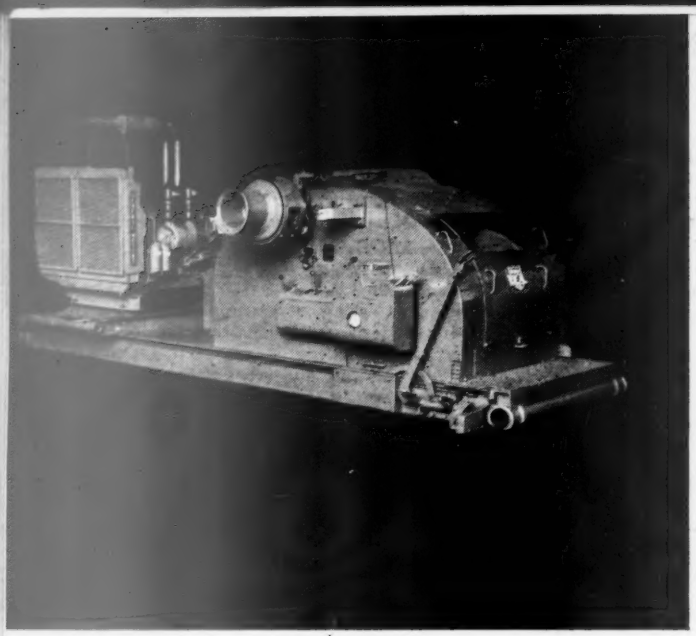
Exhibit: Oil country tubular goods, mechanical tubular products, fence, and cargotainers.

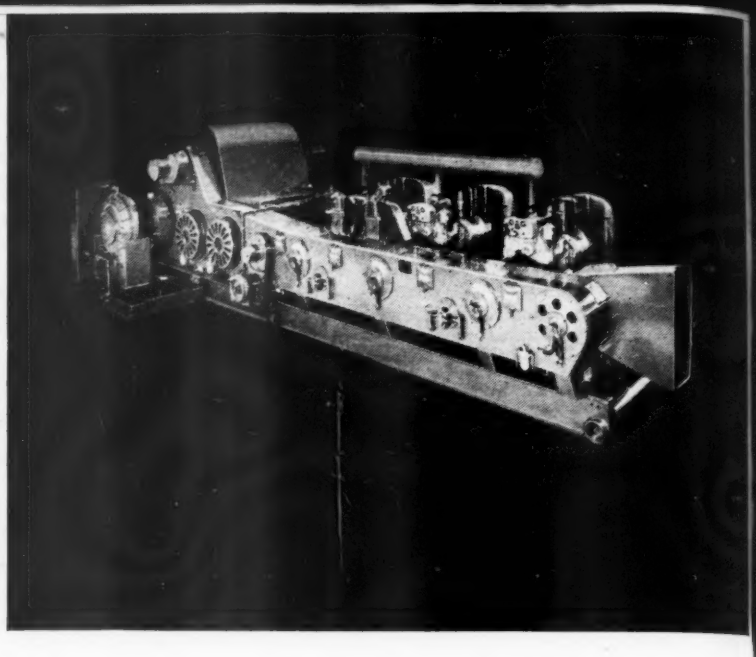
Personnel: J. H. Carter, J. K. Beeson, J. A. Voelker, G. A. Connors, C. L. Zak, E. R. Smith, A. S. Vandervort, Jr., H. S. Dershimer, T. R. Miller, G. W. Novak, J. D. Smith, J. Simonin, John Wais, and W. Rowe.

● **Pittsburgh Valve & Fittings Corp.**
Barberton, Ohio
Silver Lane, Booths 36 and 37

Exhibit: Hydro-Lube plug valve.

Personnel: L. D. Seymour, W. C. Goza, T. W. Harvey, M. A. Bradburn, N. G. Simpson,





MORE POWER

FEWER UNITS

LESS WEIGHT

LESS SPACE

GM Diesels get a Big —

General Motors Series 71 Diesel engines are a big factor in the newest oil field machinery, typical examples of which are shown on these pages. Why? Because these engines are compact and deliver great power. They snap into action and pick up their load fast—save valuable time in hauling a string out of a hole.

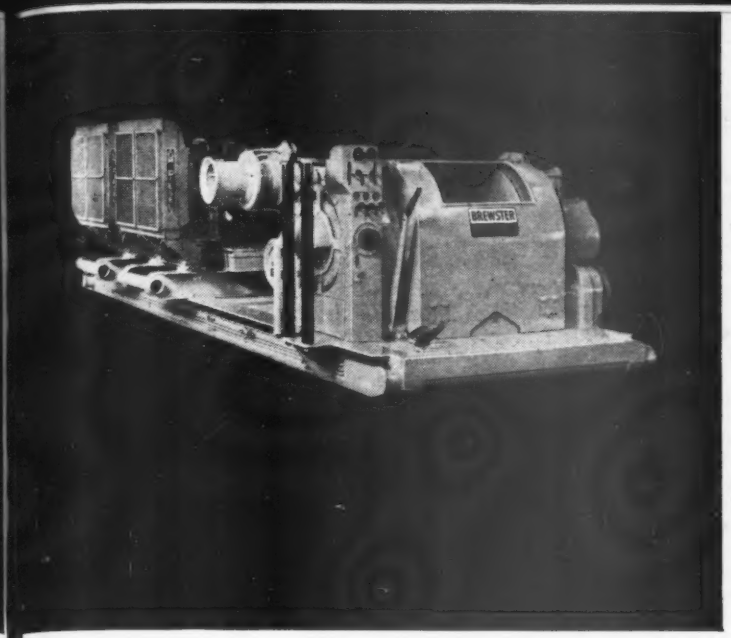
These are engines you can depend upon—engines that save on fuel and maintenance—engines that fit within road width—engines backed by world-wide service facilities.

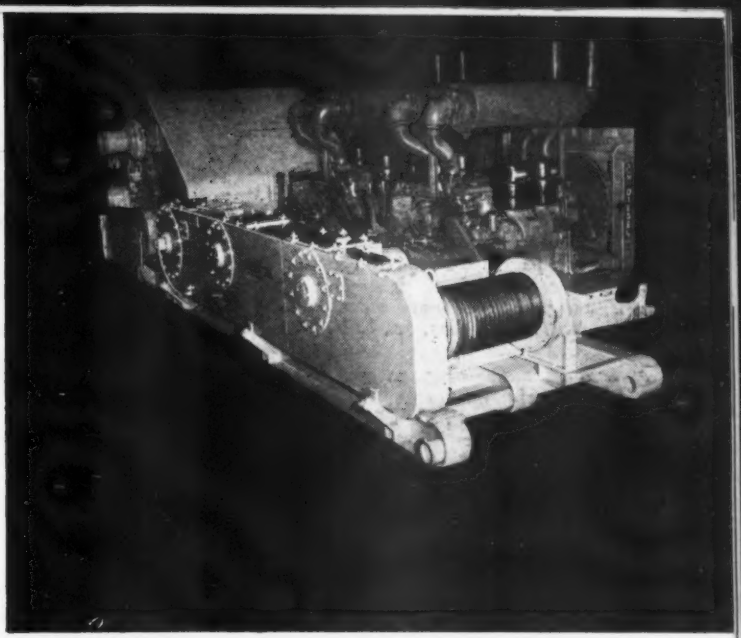
Small wonder then, that more and more operators are turning to GM Diesel-powered equipment.

DETROIT DIESEL ENGINE DIVISION

SINGLE ENGINES.. *Up to 200 H.P.* **DETROIT 28, MICHIGAN** MULTIPLE UNITS.. *Up to 800 H.P.*

GENERAL MOTORS





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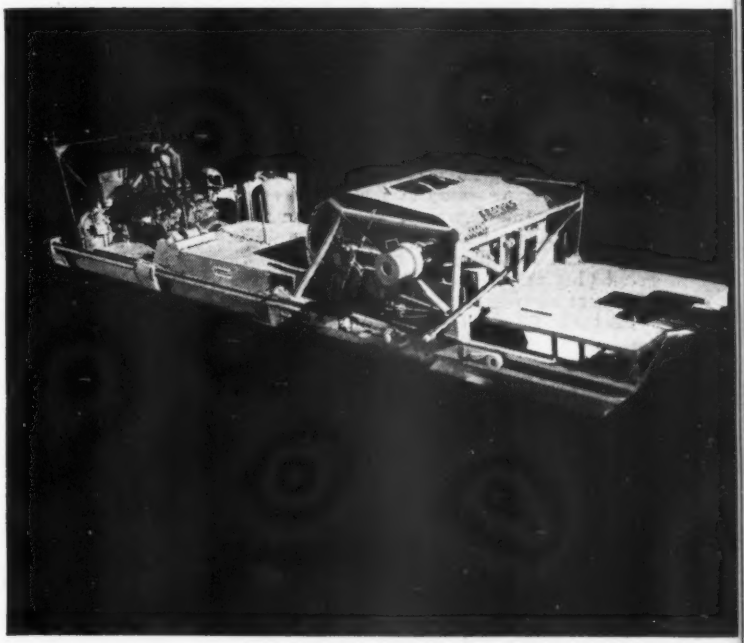
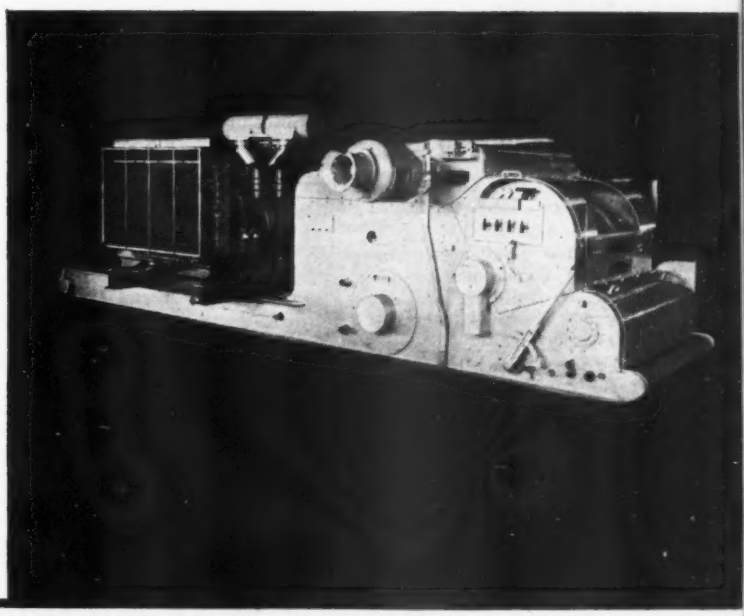




GM
GENERAL MOTORS
DIESEL POWER

Diesel Brawn without the Bulk

GENERAL MOTORS CORP., DIESEL ENGINE SALES,
PETROLEUM INDUSTRY, 1504 Philtower Bldg., TULSA 3, OKLAHOMA

Anderson-O'Brien Co.
LOS ANGELES 21, CALIFORNIA

Power Equipment, Inc.
WICHITA, KANSAS

George Engine Co.
NEW ORLEANS 18, LA.

United Tool & Valve Repair Co.
SHREVEPORT, LOUISIANA

Western Machinery & Engine Co.
ST. LOUIS 10, MISSOURI

Seitz Machinery Company, Inc.
BILLINGS, MONTANA

Diesel Power Co.
OKLAHOMA CITY, OKLAHOMA

Stewart & Stevenson Services, Inc.
HOUSTON 11, TEXAS

Empire Oil Field Machinery Co.
ODESSA, TEXAS

Gehring Equipment Co.
CASPER, WYOMING

C. E. Piper, E. L. MacBlain, and A. E. Erickson.

● **Plastelite Engineering Company**
Fort Worth, Texas
Silver Lane, Booth 14

Exhibit: Pistons and rings, compressor valve plates, rod packing, sucker rod guides, insulating pipe line fittings, light weight plastic balls, and pump valves and valve disks.

Personnel: J. A. Clay, Jr., C. F. McCamly, and G. G. Crawford.

● **Plomb Tool Company**
Los Angeles, California
Park Lane, Booth 23

Exhibit: All types of wrenches and hand tools.

Personnel: R. C. Ricke.

Tulsa address: Alvin Hotel.

● **Plymouth Cordage Products**
Plymouth, Massachusetts
Block 2

● **Poole Foundry & Machine Company**
Baltimore, Maryland
California Building, Booths 42 and 43

● **Porter Company, Inc., H. K.**
Pittsburgh, Pennsylvania
Block 5

Exhibit: Casingheads, tubingheads, rotary tool joints, rotary wear subs, rotary grief subs, blowout preventers, christmas trees, rotary substitutes, slush pump valves and seats, pipe couplings, reverse circulator, cone catcher, slush pump operated junk basket, circulating and releasing rotary overshot, safety bull plug, valve removing plug, wedge type wrist pin, retrievable back pressure valve, pipe wipers, cable drilling and fishing tools, lubricated plug valves, agitators and mixers, Devine heat exchangers, and Quimby pumps.

Personnel: T. M. Evans, G. A. Hays, W. W. Calihan, D. C. Walker, L. B. Lyons, R. H. McKay, J. E. Sawtelle, A. D. McClean, Guy F. Carle, A. C. Hauser, H. L. Arrowood, and O. B. Morphew.

● **Powell Company, The Wm.**
Cincinnati, Ohio
Texas Building, Booths 1 and 2

Exhibit: Bronze, iron, and steel valves.

Personnel: E. K. Pierce and L. E. Battin

Tulsa address: Tulsa Hotel.

● **Precision Products, Inc.**
Tulsa, Oklahoma
Oklahoma Building, Booth 42

Exhibit: Timing units and instruments.

Personnel: G. E. Nicholson, J. B. McGay and C. R. Ridley.

● **Price Co., H. C. Somastic Division**
Bartlesville, Oklahoma
Oklahoma Building, Booths 203, 204, and 247 and 248

Exhibit: Literature, Somastic coating samples, holiday detectors, and small-diameter field equipment.

Personnel: J. S. Dewar, Lloyd Bryan, R. P. White, Joyce Nicholson, and E. Rowland English.

● **Process Equipment Company**
Tulsa, Oklahoma
Kansas Building, Booth 77

Exhibit: No special items.

Personnel: Walter S. Smith and R. J. Reed

● **Process Equipment Division, H. K. Porter Co.**
See H. K. Porter Company.

● **Progressive Brass Manufacturing Co.**
Tulsa, Oklahoma
Texas Building, Booth 11

● **% Proportioneers, Inc. %**
Providence, Rhode Island
Oklahoma Building, Booth 329

Exhibit: Loss-in-weight Ethyl blender, volumetric blender for lubricating oils, gasolines, etc.

Personnel: H. W. Arduser, R. P. Lowe, and P. V. Crowther.

Tulsa address: Arduser & Company. Phone: 6-7974.

● **Protura Company**
Tulsa, Oklahoma
Texas Building, Booths 44 and 45

● **Purolator Products, Inc.**
Newark, New Jersey
Oklahoma Building, Booths 17 and 18

● **Pyle-National Co.**
Chicago, Illinois
Block V

● **Pyrene Manufacturing Company**
Newark, New Jersey
Oklahoma Building, Booths 38 and 39

Exhibit: Although a full line of portable fire extinguishers will be displayed, special emphasis will be given air foam systems and playpipes. A series of demonstrations will take place, actual oil fires to be extinguished.

Personnel: J. P. Maloney, James Faulkner, J. M. Walsh, Jr., Alonzo S. Anderson, and Patrick D. Kelly.

● **Quigley Company, Inc.**
New York, New York
Scientific and Technical Building, Booth 1

Exhibit: Bonding mortars for fire brick, light weight, medium weight and heavy weight castables, plastic fire brick, insulating fire brick, Missouri and Penna brands of fire brick, chrome plastic, chrome bonding mortar, water resistant insulation, acid-proof cements, pipe thread joint sealing compounds, industrial and house paints.

Personnel: S. F. Murphy, Jr., I. A. Pfeil, and J. W. Riddle.

● **Quigley Panel Constructions, Inc.**
New York, New York
Scientific and Technical Building, Booth 2

Exhibit: Latest improvements in insulating refractory precast panels.

Personnel: H. C. Thayer.

● **Quimby Pump Division, H. K. Porter**
Pittsburgh, Pennsylvania
Block 5
See H. K. Porter Co., Inc.

● **Railway Express Agency**
New Yorw, New York
Scientific and Technical Building, Booth 28

Exhibit: Transportataion display.

Personnel: Floyd Coberly.

Tulsa address: 7 South Main Street.

● **Ransome Company**
Emeryville, California
Scientific and Technical Building, Booth 85

● **Ransome Machinery Co.**
Dunellen, New Jersey
Oklahoma Building, Booths 189 and 190

● **Ratigan, Inc., J. P.**
Los Angeles, California
Oklahoma Building, Booth 212

Exhibit: Stuffingboxes, blowout preventers, sucker rod hooks, sucker rod elevators, sucker rod hangers, sucker rod wrenches, sucker rod wipers, sucker rod line weights, sucker rod line swivels, tubing swivels, tubing tongs, polished-rod grips and clamps, paraffin scrapers, and bell nipples.

Personnel: Charles J. Ratigan, G. M. Seybold, and L. W. Henshaw.

Tulsa address: Adams Hotel.

● **Raybesos-Manhattan, Inc.**
Manhattan Rubber Division
Passaic, New Jersey
California Building, Booth 6

Exhibit: Asbestos, friction material, packings, and oil field rubber products.

Personnel: E. W. Nagel, E. L. Alderson, L. C. Barkley, P. C. Poole, W. L. White, H. P. Wilhelm, G. C. Reed, George W. Marshall, Jr., J. E. Cole, M. S. Allen, W. K. Carr, H. C. Dishman, Thomas Hall, A. A. Ringland, C. P. Shook, J. A. Snipes, J. B. Mallard, J. A. Minnick, R. I. Hoskins, and E. A. Hamilton.

Tulsa address: Ambassador Hotel.

● **Reading-Pratt & Cady Division, American Chain & Cable Co.**
Reading, Pennsylvania
Oklahoma Building, Booths 175 and 176

Exhibit: Brass, iron, and steel valves for oil field services.

Personnel: J. J. Reed, J. P. Reed, J. P. Ferguson, J. T. Cowan, and J. C. Dilworth.

● **Rector Well Equipment Co., Inc.**
Fort Worth, Texas
Oklahoma Building, Booths 20 and 21

Exhibit: Rectorheads, Rectorseal, and Fulbore cementing equipment.

Personnel: L. L. Rector, C. W. Zartman, D. C. Davis, S. B. Schnitter, C. L. Cron, F. J. Bradford, G. A. Donaldson, W. P. Knight, J. P. Bowling, V. E. Smith, M. T. Harrell, H. B. Dragoo, C. M. Kestler, J. L. Pinkard, and M. C. Davis.

Tulsa address: Hotel Tulsa.

● **Reda Pump Company**
Bartlesville, Oklahoma
Kansas Building, Booths 50, 51, 54 and 55

Exhibit: Water well pumping unit for hydropneumatic systems, pumping equipment for oil and brine wells, and Reda stuffingboxless pumping unit.

Personnel: Joe Carle, Sergei Arutunoff, Howard F. Schultz, Oddrey Nelson, J. F. Boutwell, and S. J. Lahman.

● **Reed Roller Bit Company**
Houston, Texas
Reed Building, Drake Drive

Exhibit: Super connection drill collar, unitized blade drilling bit, all rotary drilling tools manufactured by Reed Roller Bit Company, Reed valves and Cleco pneumatic tools for industry.

Personnel: R. G. Hamaker, H. B. Book, F. L. Tyler, B. F. Hanly, S. P. Hazlip, E. A. Miller, R. C. Gann, R. F. Roberts, A. G. Chandler, W. H. Armstrong, E. C. Monroe, J. R. Brandon, and R. V. Ellis.

Tulsa address: Tulsa or Mayo Hotel.

● **Refinery Supply Company, The**
Tulsa, Oklahoma
Scientific and Technical Building, Booths 8, 9, and 10

Exhibit: Recording gravitometer, specific gravity gas balance, pressure vacuum pump, portable vacuum pump, mercury cleaner, manometer, dead weight gauge, dead weight tester, orifice well tester, moister tester, flat bore Yel-O-Bak thermometers, streamlined hydrometers, pulsameter, pressure hydrometer jars, vapor pressure bomb, diamond core drill, thermo plumb bob thermometers, thermostat temperature controls, high pressure consistometer, and smoke meters.

Personnel: W. A. Schlueter, H. F. Goodenough, J. B. Okeson, T. C. Williams, V. F. Sweeney, Karl Weiss, and Charles Hinkle.

● **Regan Forge and Engineering Co.**
San Pedro, California
Oklahoma Building, Booths 198, 199, 200, 251, 252, and 253

Exhibit: Crown blocks, traveling blocks, hooks, blowout preventers, and other items.

Personnel: Thomas J. Regan, Joseph Regan, B. S. Minor, Richard Regan, Louis Regan, and Ed. Kirby.

● **Reilly Tar & Chemical Corporation**
Indianapolis, Indiana
Scientific and Technical Building, Booths 5 and 6

Exhibit: Coal tar enamels for pipe line protection. (See also Steve C. Maples and Company).

● **Republic Rubber Division**
Lee Rubber and Tire Corp.
Youngstown, Ohio
Block 1

Exhibit: Mechanical rubber products used in the production, transportation, and marketing of petroleum products, in addition to samples representing the company's general line of industrial mechanical rubber products.

Personnel: N. M. Grove, M. C. Meyer, and C. H. Zieme.

Tulsa address: Hotel Tulsa.

● **Republic Steel Corporation**
Cleveland, Ohio
Kansas Building, Booths 102-115, inclusive

Exhibit: Products of Pipe Division, Alloy and Stainless Steel Division, Steel and Tubes Division, Bolt and Nut Division, Niles Steel Products Division, and perhaps an item or two from the Truscon Steel Company, subsidiary. In addition, will show items manufactured by customers of Republic Steel. These will include bubble caps, barrel tubing bushing, rock bits, pump liners, fishtail bit, screen pipe, tongs, still tubes, and weldless jars. etc.

Personnel: Manly B. Brown, F. H. Ramage, W. E. Fruhan, Giles Locke, E. E. Haubegger, Henry A. Bourne, R. A. Lieser, C. W. Ruth, and E. E. Bang.

Tulsa address: 2004 Philtower Building.

● **Republic Supply Company**
Houston, Texas
Kansas Building, Booths 99, 100, 101, 116, 117, and 118

Exhibit: Advertising display showing location of stores and offices and listing products distributed by the company.

Personnel: J. H. Brooks, A. V. Matheny, W. W. Clift, E. H. Beard, P. L. Jordan, and F. S. Fleming.

Tulsa address: 716 Thompson Building. Phone: 3-9176.

● **Ridge Tool Company**
Elyria, Ohio
Texas Building, Booths 28, 29, 30

Exhibit: Complete line of Ridgid tools together with the new 4-P 2½ to 4-in. geared threader, as well as the new Porta-Power drive.

Personnel: R. C. Chamberlin, Seth W. Smith, R. D. Fye, E. C. Bliss, and W. L. Parcell.

Tulsa address: Hotel Tulsa.

● **Robinson Orifice Fitting Company**
Los Angeles, California
See Westcott & Greis, Inc.

● **Rochester Ropes, Inc.**
Culpeper, Virginia
Texas Building, Booth 125

Exhibit: Rotary drilling lines, clean-out lines, cable tool drilling lines, industrial wire lines, core barrel lines, sand lines, winch lines, spring lay rope, nylon covered rope, and tubing and rod lines.

Personnel: W. L. Rochester, E. E. Lambert, J. S. Blackman, Paul Murray, H. C. Kinney, Jr., and James A. Halbert.

Tulsa address: Mayo Hotel.

● **Rockwell Manufacturing Company**
Pittsburgh, Pennsylvania
Scientific and Technical Building, Booths 33-38 inclusive

Exhibit: Nordstrom products will include lubricated plug valves in a complete range of sizes, types, and metals, with working pressures from 175 psi to 10,000 psi WOG; wrench, gear, and power operated. A new Norstrom product will be high pressure Hyperseal Nordco alloy-steel valves. In addition, Nordstrom will show Hyperseal Merchrome coated valves of 13 per cent chromium, two-bolt cover type valves, standard screw and bolted gland types and Multiports in semi-steel, Nordco steel, and special alloys.

Edward Valves, Inc., subsidiary company, will display forged and cast-steel stop, check, gate, non-return, hydraulic, gage, blow-off, Intex, gelded bonnet Univalve, relief valves, strainers, and packing.

Pittsburgh Equitable Meter Division will display oil, gas, and water meters and gas pressure regulators.

Hydraulic Division will show the new Rockwell Rotocycle pump.

● **Rollway Bearing Company, Inc.**
Syracuse, New York
California Building, Booths 42 and 43

Exhibiting: Ball and roller bearings, flexible couplings.

Personnel: Rollway Bearing Company: E. R. Francis, J. E. Sero; Aetna Ball & Roller Bearing Company: W. A. Wood, J. J. Rozner; Poole Foundry & Machine Company: L. M. Ricketts; Factory representatives: C. W. McNeil and M. P. Kluppel.

● **Rolo Manufacturing Company**
Houston, Texas
Block V

Exhibit: Vertical and horizontal wellcheckers, oil well meters with automatic BS & W samplers.

Personnel: R. K. Franklin, Wm. A. Swan, George R. Woods, and M. F. Delano.

Tulsa address: Hotel Tulsa.

● **Roper Corporation, George D.**
Rockford, Illinois
See Harley Sales Company

● **Ross-Martin Company**
Tulsa, Oklahoma
Scientific and Technical Building, Booth 13

Exhibit: Geological and land department equipment and supplies, including filing equipment for rolled maps, electric well logs, graphic well logs, Kraftbilt precision well logs and general oil industry standard forms.

Personnel: Bert Brammer, Marshall H. Massey, R. T. Curtis, and J. M. Lanigan.

● **Ruska Instrument Corporation**
Houston, Texas
Scientific and Technical Building, Booth 85

Exhibit: Magnetic surveying instruments for magnetic prospecting, core analysis instruments, high pressure laboratory pumps and other instruments for petroleum engineering and refinery research.

Personnel: Walter Ruska and Claude E. Miks.

● **Sapulpa Tank Co.**
Sapulpa, Oklahoma
Park Lane, Booth 34

● **Sarco Company, Inc.**
New York, New York
See Steve C. Maples & Co.

● **Sargent & Co., E. H.**
Chicago, Illinois
Scientific and Technical Building, Booth 26

Exhibit: Laboratory apparatus; Polarograph, constant temperature viscosimeter bath, cone drive stirring motor, hydrometers, and thermometers.

Personnel: R. L. Osburn and Ray Moser.

● **Sargent Engineering Corporation**
Huntington Park, California
Block 9

● **Schlumberger-Surenco**
Houston, Texas
See Schlumberger Well Surveying Corporation.

● **Schlumberger Well Surveying Corporation**
Houston, Texas
Scientific and Technical Building, Booths 66, 67, 68

Exhibit: Well surveying equipment, including modern photographic electric well logging recorder. Surface controls for Schlumberger auxiliary services such as side-wall coring, dipmeter surveys, photoclinometer directional surveys, section gauge surveys, radioactivity logging, precision gun perforating, radioactive marker surveys, and induction logging are included as an integral part of the new equipment. The subsurface equipment used for each of the services mentioned also will be exhibited.

● **Schramm, Inc.**
West Chester, Pennsylvania
Texas Drive, Booths 9 and 10

Exhibit: No. 60 self-propelled crawler type compressor, and other new models.

Personnel: Harold J. Schramm and Lloyd Pratt.

Tulsa address: Bliss Hotel.

● **Scintilla Magneto Division, Bendix Aviation Corporation**
Sidney, New York
Oklahoma Building, Booths 9 and 10

Exhibit: Aircraft and industrial ignition systems, fuel injection equipment for diesel engines, electrical connectors, samples of ceramics and moldings.

Personnel: B. L. McGregor and A. J. Poole, Jr.

● **Scott-Rice Company**
Tulsa, Oklahoma
Oklahoma Building, Booths 7 and 8

● **Sealmaster Bearings Division, Stephens-Adamson Mfg. Co.**
Aurora, Illinois
Scientific and Technical Building, Booth 40

● **Security Engineering Company, Inc.**
Whittier, California
Block 11

Exhibit: Rock bits, coring bits, trigger bits, hole openers, casing scrapers, Sievers reamers, Securaloy products and accessories.

● **Seismograph Service Corporation**
Tulsa, Oklahoma
Scientific and Technical Building Booths 75 and 76

Exhibit: Earth motion recorder.

Personnel: A. J. Barthelmes, R. S. Finn, G. M. Giltinan, J. E. Hawkins, T. A. Manhart, R. W. Mossman, G. W. Reed, H. M. Thralls, and G. H. Westby.

● **Shafer Bearing Corporation**
Chicago, Illinois
Scientific and Technical Building, Booth 40

● **Shaffer Tool Works**
Brea, California
Oklahoma Building, Booths 1 and 2

Exhibit: High pressure drilling and control equipment, casing, landing and tubingheads, adjustable flow beans, fishing tools, and the Shaffer-Waggener bumper safety joints.

● **Shell Oil Company**
Tulsa, Oklahoma
Scientific and Technical Building, Booth 39

Exhibit: Two of a series of five movies entitled "Prospecting for Petroleum" and "The Birth of an Oil Field."

Personnel: C. L. Stinnett.

Tulsa address: Mayo Building.

● **Sheppard Company, R. H.**
Hanover, Pennsylvania
Block 3

● **Shrimpton Equipment Company**
Los Angeles, California
See Minneapolis-Moline Power Implement Company.

● **Sight Feed Generator Company**
Richmond, Indiana
Kansas Building, Booth 32

Exhibit: Portable acetylene generator, "il field special" portable acetylene generator.

Personnel: Carl F. Smith, Ralph L. Kennedy, and M. J. Van Dreser.

● **Simplex Company, The**
East Moline, Illinois
Block G

Exhibit: Voltage regulators for A-C generators.

Personnel: M. Debrey and Max E. Landry.

Tulsa address: Hotel Tulsa and 533 Mayo Building.

● **Skelgas Division, Skelly Oil Company**
Kansas City, Missouri
Kansas Building, Booths 46, 47, 58, 59

Exhibit: Domestic gas burning appliances, home freezers, cylinder type operating equipment and heavy duty systems, complete model kitchen, and small items.

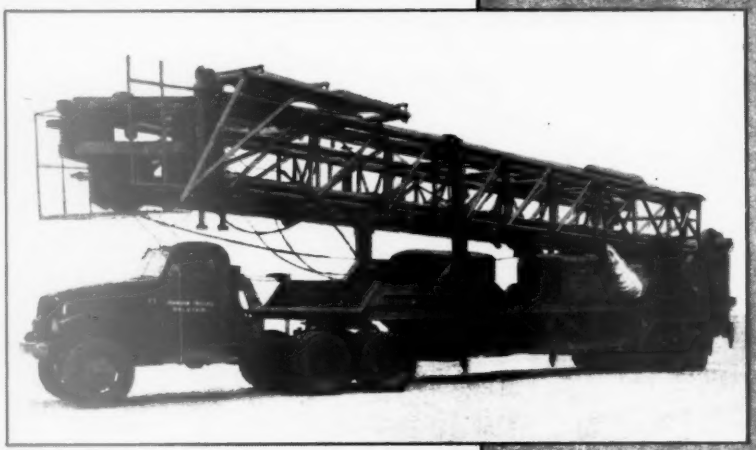
Personnel: R. L. Gage.

Tulsa address: Company office at 5440 East 11th.

"CARDWELL" EQUIPMENT

9 RIGS ON DISPLAY AT THE TULSA OIL SHOW

"CARDWELL" TRAILERIG



Complete, self-contained, twin-engine drilling and servicing rig. Fully portable without dismantling block, mast or engines. Recommended for drilling to 5,000 feet with 4½-inch drill pipe and workover jobs to 10,000 feet.

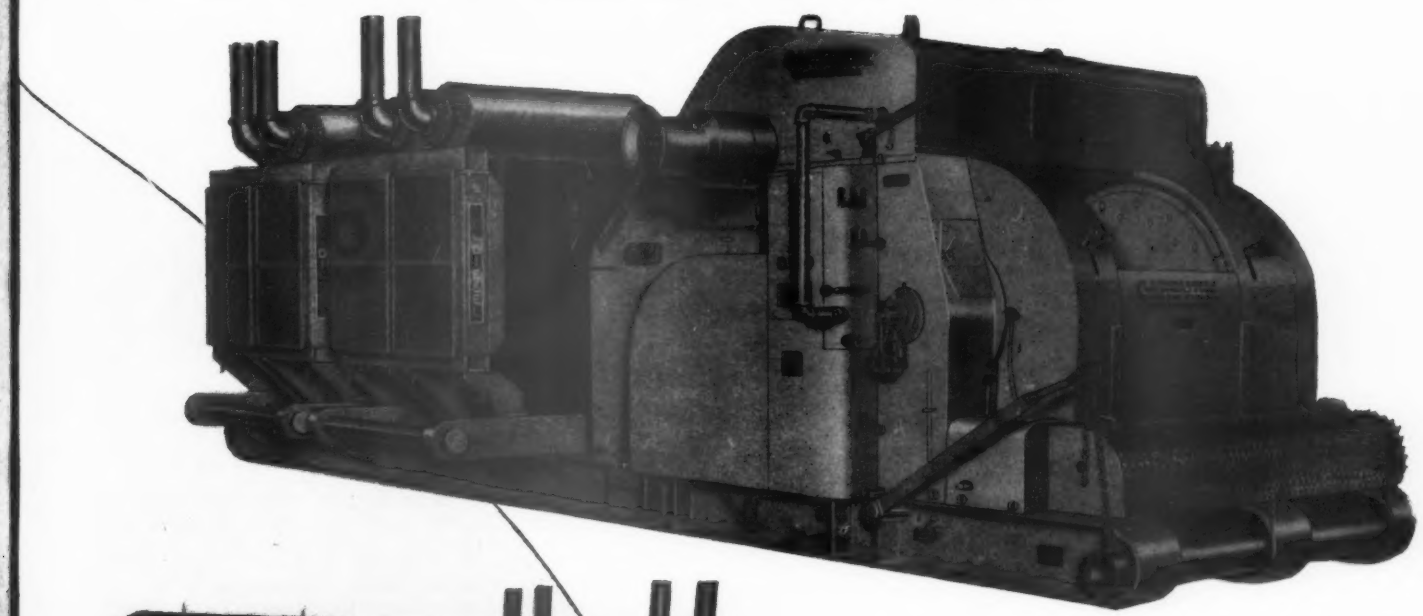
FEATURES: Portability Plus. Rig is transported with lines reeved up and can be ready for operation in thirty minutes after reaching location. Two-way hydraulic system automatically controls mast when going over center without use of guy or snubbing line. Unobstructed floor space 15x16½ feet with plenty of space for blowout preventer equipment without use of ramps. Draw works has "Cardwell" Air-Disc clutches throughout. Air-Disc clutches in both ends of drum provide high and low drum speeds operated by single lever. All necessary hoisting, mud pump and table speeds available simultaneously. Optional sand line drum has "Cardwell" Air-Disc clutch.

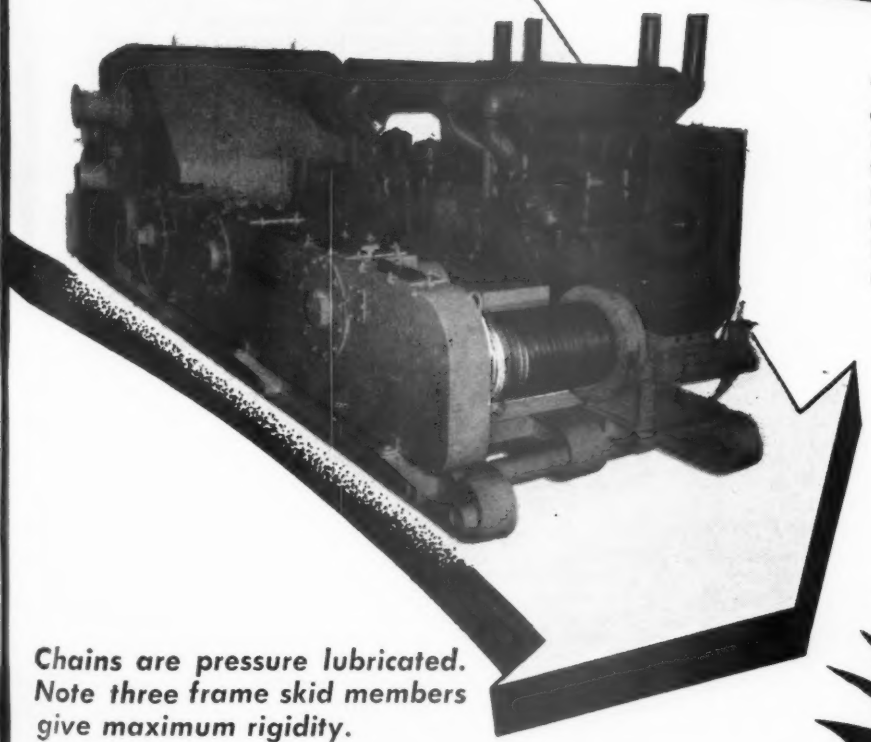
Pneumatic-tired trailer model is 59′ 3″ high and 8′ wide. Athey tracks are available.

THAT'S YEARS AHEAD

WITH "CARDWELL" AIR-DISC FRICTION CLUTCHES IN BOTH ENDS OF THE DRUM

"CARDWELL" MODEL O, 8,000-FOOT TWIN-ENGINE DRAW WORKS — A FAST-OPERATING RIG — HEAT-TREATED WEARING PARTS THROUGHOUT FOR STAMINA AND TROUBLE-FREE OPERATION.





Chains are pressure lubricated. Note three frame skid members give maximum rigidity.

"Cardwell" Air-Disc clutches in both ends of drilling drum provide a high and low drive, and is operated by a single lever. Air clutches throughout. Heavy-duty chain transmission has three speeds forward and one reverse. Brakes are dual safety, self energizing, full wrap type. Hydromatic brake optional equipment. Flanges are machined and heat-treated to 550-600 Brinnell (54-58 Rockwell C) to give long life without replacement. Flanges are ground to insure maximum life of brake blocks. Rig may be transported on one truck with engines in place—is within eight-foot road limit with engines removed.

IT WILL PAY YOU TO SEE THE "CARDWELL" EQUIPMENT AT THE OIL SHOW

CARDWELL MFG. CO. INC.

P. O. Drawer 2001 . . . Long Distance Telephones 128 – 129 – 130
Cable Address: "ALL STEEL," Wichita — "CARDSTEEL," New York
Wichita, Kansas, U. S. A.

● **S K F Industries, Inc.**
Philadelphia, Pennsylvania
Texas Building, Booths 67 and 68
Exhibit: Spherical roller bearings and pillow blocks designed for heavy duty application.
Personnel: C. D. Cummings, A. S. Murray, R. C. Byler, J. L. Brusca, H. L. Gaddis, Robert M. Bruce, A. H. Dixon, W. F. Weidner. and V. A. Menaglia.
Tulsa address: Mayo Hotel.

● **Smith Corporation, A. O.**
Milwaukee, Wisconsin
Oklahoma Building, Booths 177-180 inclusive
Exhibit: LPG systems, Smithway water heaters, tubular products, vessels, and Smith meters.
Personnel: R. J. Amann, A. E. Butts, Norman George, Jack Blanco, J. C. Riley, Jr., J. F. Donnelly, H. H. Needham, J. P. Parker, W. R. Kepler, and D. F. McCarthy.
Tulsa address: Company office at 805-6 Thompson Building.

● **Smith Meter Company**
Los Angeles, California
Scientific and Technical Building, Booths 83 and 84
Exhibit: Transport truck meters, bulk plant and loading rack meters, refinery process, pipe line and production meters, ground reading liquid level gage and automatic electric remote reading liquid level gage.
Personnel: Harry G. Smith, J. W. Harris, R. C. Weldon, and W. G. Moser.
Tulsa address: Hotel Tulsa.

● **Snap-on Tools**
Kenosha, Wisconsin
Park Lane, Booth 5
Exhibit: Hand tools, torque wrenches, and new "roughneck" set.
Personnel: Paul S. Thompson, F. M. Lourigan, K. Clark, E. L. Spencer, C. McLane, and M. B. Steinmetz.
Tulsa address: Mayo Hotel.

● **Sonner Burner Company, The**
Winfield, Kansas
Oklahoma Building, Booths 159 and 160
Exhibit: Oilfield burner, house heating burner, and non-freeze valve.
Personnel: P. J. Sonner, S. A. Swoyer, Max V. Stocking,and R. A. Blizard.

● **Southwest Box Company**
Sand Springs, Oklahoma
Kansas Building, Booth 18

● **Spang and Company**
Butler, Pennsylvania
California Building, Booths 44, 45, 60, 61
Exhibit: Jars, bits, packers, and fishing tools.
Personnel: Ferd J. Spang, C. E. Spang, George Fish, Jr., L. F. Porter, O. B. Pierce, T. Troll, and F. J. Ripper.

● **Spang-Chalfant Division, National Supply Company**
Pittsburgh, Pennsylvania
Block 1
See National Supply Company.

● **Sparkler Manufacturing Company**
Mundelein, Illinois
Scientific and Technical Building, Booth 14

● **Specialty Sales and Service, Inc.**
Tulsa, Oklahoma
Kansas Building, Booths 20 and 22
Exhibit: Dempsey hydraulic subsurface pump, Willis adjustable flow bean and the Willis metering valve.
Personnel: M. L. Walraven, Jr., M. Leslie Walraven, O. E. Dempsey, R. S. Willis, and C. L. English.

● **Square D Company**
Milwaukee, Wisconsin
Oklahoma Building, Booths 60 and 61
Exhibit: Circuit breaker power panel, multi-breaker lighting panel, circuit breakers and switches, plug-in and feeder duct, motor control accessories, section of a control center, switching relays and timers, A-C contactors and starters, manual and magnetic starters, fusible switch type pumping plant panel.
Personnel: F. H. Roby, C. L. Hull, R. Walker, W. E. Neal, W. H. Bodle, and Edmonds Love.
Tulsa address: Alvin Hotel and Bliss Hotel.

● **Stacey Brothers Gas Construction Co.**
Cincinnati, Ohio
Block 11
Exhibit: Miniature model oxygen generating plant, flow charts on oxygen plants, heavy aluminum welding specimens, gasholder, high pressure tanks, purifiers, etc.
Personnel: A. E. Harvey, A. A. Azar, E. N. Bonnett, and James J. Hogan.

● **Standco Brake Lining Company**
Houston, Texas
Block 3

● **Steel Improvement and Forge Co.**
Cleveland, Ohio
Oklahoma Building, Booth 229
Exhibit: Drop forgings, boiler and tank manhole and handhole covers, and ring gaskets.
Personnel: C. H. Smith, Jr., H. A. Zimmerman, T. L. Moore, and H. M. Dunn.
Tulsa address: T. L. Moore, National Bank of Tulsa Building. Phone: 2-0058.

● **Stentz Equipment Company**
Tulsa, Oklahoma
Kansas Building, Booths 83, 84, and 85
Exhibit: Seco automatic tank shut-off valves and switches for production, pipe line, and refining.
Personnel: S. L. Stentz, Harry Kaindl, and Carl Hample.

● **Sterling Machinery Corporation**
Kansas City, Missouri
East of Block T

● **Sterling Packing & Gasket Co.**
Houston, Texas
Park Lane, Booth 7
Exhibit: Drilling, producing, pipe line, and refinery packings and gaskets.
Personnel: C. A. Polk, J. L. Dore, C. L. Fenity, R. C. Mandeville, C. D. Forberg, A. G. Wilcox, J. O. Meynier, A. L. Brasseux, Paul R. Nordstrom, A. L. Gaut, Fred J. Barnett.

● **Stewart & Stevenson Services**
Houston, Texas
East of Block V
Exhibit: Electric auxiliary units, General Motors marine and industrial diesels, Continental gas engines, and centrifugal pumping unit that is enclosed and mounted on trailer
Personnel: Joe Manning, Harvey Trotter, C. L. Ward, E. E. Childress, and Ross Stewart.
Tulsa address: Tulsa Hotel.

● **St. Louis Cordage Mills**
St. Louis, Missouri
Texas Building, Booth 89
Exhibit: All types of Manila oil field cordage.
Personnel: Wm. T. Davis, Wm. J. Ward, and Harold V. Pate.
Tulsa address: Tulsa Hotel.

● **Stoody Company**
Whittier, California
Silver Lane, Booth 43
Exhibit: Hard-faced oil field parts of all types, showing correct hard-facing procedures.
Personnel: George F. Staley, Harold W. Sharp, Arthur Anderson, and Charles Myrow.

● **Strom Steel Ball Co.**
Cicero, Illinois
Scientific and Technical Building, Booth 40

● **Struthers-Wells Corporation**
Warren, Pennsylvania
Kansas Building, Booth 77

● **Subsurface Engineering Company**
Houston, Texas
Scientific and Technical Building, Booth 23

● **Sun Engineering Company**
Oklahoma City, Oklahoma
Oklahoma Building, Booth 87
Exhibit: Lube and fuel oil filters.
Personnel: Ted Harrington and Lloyd Hopeman.

● **Superior Engine Division, National Supply Company**
Springfield, Ohio
Block 1 and 9
See National Supply Company.

● **Synchro-Start Products, Inc.**
Chicago, Illinois
Oklahoma Building, Booth 164
Exhibit: Automatic engine controls.
Personnel: William J. Williams and C. A. Genske.

● **Synthane Corporation**
Oaks, Pennsylvania
Oklahoma Building, Booths 74 and 75
Exhibit: Laminated phenolic materials in basic forms of sheets, rods and tubes, macerated molded phenolic parts, and laminated molded phenolic parts.
Personnel: R. R. Titus, J. B. Rittenhouse, H. Widdop, Ernest Bernard, Gene Rankin, and F. C. McCamly.

● **Tal Bender, Inc.**
Milwaukee, Wisconsin
Oklahoma Building, Booth 256
Exhibit: Pipe and tube bending equipment.
Personnel: E. T. Tal, Mrs. C. Tal, E. Habermehl, H. C. Gardner, and L. M. Gardner.

● **Taylor Forge and Pipe Works**
Chicago, Illinois
Block 9

● **Taylor Instrument Companies**
Rochester, New York
Scientific and Technical Building, Booths 31, 32, and 87
Exhibit: Aneroid manometers, new transmitter, pilot-venturi and pre-calibrated orifice section.
Personnel: F. S. Ward, A. J. Fleig, R. E. Clarridge, R. E. Flikkema, G. E. Howard, R. Van De Carr, O. F. Hunter, A. R. Wagner, R. E. Bailey, and J. C. Laley.
Tulsa address: Company office at 613-615 East Fourth Street.

● **Taylor Winfield Company**
Warren, Ohio
Oklahoma Building, Booths 189 and 190

● **Technical Oil Tool Corporation, Ltd.**
Los Angeles, California
Oklahoma Building, Booths 192 and 193
Exhibit: Recorder for controlled vertical drilling, directional recorder, 1-5/16-in. C. V. D. recorder for small bore drill collars, and chronometric tachometers.
Personnel: J. B. Wood, H. H. Peters, and P. T. Bannerman.

● **Telematic Corporation**
Chicago, Illinois
Kansas Building, Booth 64
Exhibit: Remote control liquid level gauges.
Personnel: Jay D. Kettering and Eugene T. Sliwinski.
Tulsa address: 2412 East 14th Place.

● **Texas Rubber Specialty Corporation**
Houston, Texas
Block 3

● **Texoma Supply Company**
Tulsa, Oklahoma
Booths 69, 70, and 71
Exhibiting: Oil well pumping equipment.
Personnel: Ray H. Smith.
Tulsa address: 120 East Ninth Street.

● **Texsteam Corporation**
Houston, Texas
Park Lane, Booth 33

● **Thermoid Company**
Trenton, New Jersey
Silver Lane, Booth 28
Exhibit: Rotary hose, slush pump hose, miscellaneous types of hose, brake lining, brake blocks, wire line savers, wire line turn backs,

stuffingbox rings, molded products, and miscellaneous products for the oil fields.
Personnel: A. F. Matheis and Norris Green.
Tulsa address: 2530 South Cincinnati.

● **Thew Shovel Company**
Lorain, Ohio
Outside, next to Hall of Science
Exhibit: Model TL-20 hoe mounted on a wide gauge crawler, Model TL-20 rubber-tire Motor-Crane, Model Lorain-41 crawler dragline, and Model MCO416 Moto-Crane, 20-ton capacity.
Personnel: D. G. Savage, J. L. Beltz, G. H. Thorgeson, and T. H. Fortner.

● **Thomas Laughlin Company, The**
Portland, Maine
Park Lane, Booth 8
Exhibit: "Fist grip" wire rope clips, safety hoist hooks, clevis hoist hooks, clevis grab hooks, other wire rope and chain accessories.
Personnel: Lewis M. Gardner, Myron H. S. Affleck, and D. W. Huff.
Tulsa address: New Albany Hotel.

● **Thompson Pump Company**
Okmulgee, Oklahoma
Oklahoma Building, Booth 132
Exhibit: Various type pumps, seating devices and valves.
Personnel: R. D. Thompson, Frank Wilcom, Ed. H. McCune, and J. R. Thompson.

● **Thornhill-Craver Company, Inc.**
Houston, Texas
Kansas Building, Booths 67 to 72
Exhibit: Malleable iron Unibolt couplings, malleable iron Unibolt tees, malleable iron Unibolt crosses, steel couplings, steel "big inch" couplings, steel welding neck couplings, steel pipe line couplings, steel scraper trap couplings, steel tees, steel crosses, steel cage nipples and beans, steel christmas tree wing valves, steel chokes (adjustable and positive), and steel flexi-ball joints.
Personnel: C. W. Thornhill, H. E. Thornhill, Kenneth Craver, J. K. Skeehan, Earl Grissom, J. C. Henbree, W. W. Walmsley, M. E. Moore, F. Van Matre, W. A. Hammann, J. E. Loeffler, and O. L. Nordin.

● **Timken Roller Bearing Company**
Canton, Ohio
Oklahoma Building, Booths 149 and 150
Exhibit: Bearings and seamless steel tubing.
Personnel: W. B. Moore, M. H. Kuhl, S. M. Weckstein, H. W. Trump, S. C. Partridge, P. C. Poss, W. F. Anderson, H. B. Lilley, C. H. McCollam, D. S. Klippert, W. E. Taggart, G. E. Reed, R. L. Wilson, C. L. Clark, Ralph Frerichs, Carl Girtler, and Paul J. Reeves.

● **Tool Steel Gear and Pinion Company**
Cincinnati, Ohio
Park Lane, Booth 29
Exhibit: Slush and booster pump liners, sprocket rims, sheaves (crown and traveling blocks).
Personnel: C. R. Burrell, L. R. Brooks, J. C. Seeger, H. H. Kumler, L. T. Elliott, Leon Ince, and R. T. Stewart.
Tulsa address: 2621 East 22nd Place.

● **Torrington Company, Bantam Bearings Division**
South Bend, Indiana
Oklahoma Building, Booths 185 and 186
Exhibit: Anti-friction bearings, including self-aligning spherical roller, tapered roller radial, straight roller radial, heavy duty needle roller, ball radial, straight roller, and conical roller thrust bearings.
Personnel: R. B. Nichols, R. T. Dunlap, H. C. Olson, J. A. Toth, Leo A. Toth, and G. E. Marvel.
Tulsa address: 1724 South Gary Place. Telephone under name of Paul W. Langford.

● **Towmotor Corporation**
Cleveland, Ohio
Southwest of Cafeteria

● **Trackson Company**
Milwaukee, Wisconsin
Block E
Exhibit: MD8 pipe layer, T6 Traxcavator, PD4 pipe layer and anglefiller, and CD4 swing crane.
Personnel: W. H. Stiemke, L. E. Dauer, G. E. Allen, A. B. Morse, L. C. Frank, N. M. Erdahl, J. J. Keyes, Wm. Grau, M. A. Thomason, and O. W. Cole.
Tulsa address: Tulsa Hotel.

● **Treat-Rite Chemical Company**
Nowata, Oklahoma
Kansas Building, Booth 36
Exhibit: Water treating system, H & T water softening equipment.
Personnel: Paul DeLozier and Geo. Hayworth.

● **Tretolite Company**
Webster Groves, Missouri
Block 4
Exhibit: Complete treating system, field treating equipment, new Tret-o-Lite formulas.
Personnel: K. R. Farr, F. L. Kelley, J. S. Lehmann, J. V. Janes, T. G. Allen, Howard Andrews, Russell C. Anduss, N. S. Austin, L. A. Bainter, Lee Bassham, O. L. Bassham, E. A. Baumstark, A. A. Beavers, Claude C. Best, W. M. Best, Mark Bolles, L. C. Camblin, Dan H. Carpenter, R. O. Corley, Lee Cruce, C. L. Davenport, E. H. Dayvault, Louis C. Dessert, W. N. Eddins, W. N. Eddins, Jr., C. W. Fornes, Al Gates, Allen Groff, Leo Grounds, Lawrence W. Hale, Guy F. Harrison, T. H. Herman, Jr., Harry S. Horton, Lester L. Hunter, R. V. Johnston, J. Keevil, F. L. Kelley, H. V. King, C. L. Kleinschmidt, Jr., Howard R. Land, Mont Land, Ira W. Lind, B. B. McDaniel, T. L. Modgling, J. R. Moechel, M. J. Mullally, D. C. Norcross, W. A. Odom, Murl R. Ogden, Wm. G. Persons, W. W. Potts, Robert E. Power, Charles Prater, Jr., Aaron Ratliff, Wm. T. Roach, J. B. Robinson, C. C. Rogers, Jr., Frank Segrest, S. B. Senter, Dale Shappell, S. B. Smith, Jr., Warner A. Smith, S. E. Tenan, W. N. Thurston, W. G. Tune, E. A. Waldrop, R. A. Waters, A. D. Watson, and John W. Wood.

● **Triangle Blue Print and Supply Company**
Tulsa, Oklahoma
Oklahoma Building, Booth 214
Exhibit: Keuffel & Esser drawing equipment, Ozalid products, Spencer microscopes, Gurley surveying instruments, Post drawing equipment, American Paulin barometers, and Ultra-Violet Company Mineralight.
Personnel: L. C. Burchfield, H. O. Wilkerson, Fred Rose, R. P. Perrault, Leonard Potts, and M. F. Corbin.

● **Trinity Portland Cement Division, General Portland Cement Co.**
Dallas, Texas
Oklahoma Building, Booths 85 and 86
Exhibit: Inferno portland cement, high early strength portland cement, standard portland cement, gel-cements, and white portland cement.
Personnel: J. A. Barnes, U. P. Kennedy, I. F. Bingham, H. L. Moseley, and J. B. Parrott.
Tulsa address: Tulsa Hotel.

● **Tubbs Cordage Company**
San Francisco, California
Block 9
Exhibit: Manila catlines, and manila drilling cables.
Personnel: W. I. Atherton, Robert P. Hurst.

● **Tube Turns, Inc.**
Louisville, Kentucky
Texas Building, Booths 132 and 133
Exhibit: Welding fittings and flanges, carbon steel, stainless steel, aluminum, chrome moly, and nickel.
Personnel: J. G. Seiler, J. W. Green, T. H. Pike, Jr., R. S. Tyler, Jr., Carl McLaughlin, and J. D. Mattimore.
Tulsa address: Mayo Hotel.

● **Tuboscope**
Houston, Texas
Park Lane, Booth 30
Exhibit: Various types defects found in both new and used oil field tubular goods, Tuboscope instrument including latest developments such as the internal depth contour gauge and the new magnifier designed to change the magnification of defects internally.
Personnel: J. W. Bozeman, V. D. Goins, R. C. Lewis, Harry Bozeman, B. H. Pickard, and C. R. O'Dell.
Tulsa address: Mayo Hotel.

● **Tulsa Paper Company**
Tulsa, Oklahoma
Kansas Building, Booths 91 and 92
Exhibit: Industrial tapes, gum tape and waterproof papers, toilet seat covers, nibroc towels, waterproof and building paper, toilet tissue, sand sample envelopes, paper cups and mailing and map tubes.
Personnel: A. N. Jochem, J. P. Boddy, E. J. Lawyer, W. R. Charon, R. H. Kirkley, C. E. Kelley, W. J. Baker, J. W. Taylor.

● **Tulsa Tool & Pump Company**
Tulsa, Oklahoma
Texas Building, Booths 57 and 58

● **Tulsa Winch Division of Vickers, Inc.**
Tulsa, Oklahoma
Block 3
Exhibit: Power winches for trucks and tractors having transmissions custom built.
Personnel: Edward A. Thompson, J. M. Ledterman, and Bob Owen.

● **Turney Manufacturing & Engineering Company**
Houston, Texas
Block 103

● **Twin Disc Clutch Company**
Racine, Wisconsin
Oklahoma Building, Booths 166 and 167
Exhibit: Air actuated clutch, hydraulic couplings, power take-off hydraulic torque converters, and heavy duty clutch.

● **Tyson Roller Bearing Corporation**
Massillon, Ohio
Kansas Building, Booths 43, 44, 45, 60, 62, 63

● **Union Carbide and Carbon Corp.**
New York, New York
Oklahoma Building, Booths 237 and 238
Exhibit: Live demonstration showing the fabrication of Hastelloy and Multimet alloys, stainless steel, aluminum, copper and magnesium by the Heliarc welding process. Haynes Stellite Company will show Hastelloy nickel base alloys and Multimet high temperature alloys. A display of hard-facing alloys and several typical oil field parts that have been protected by hard-facing will also be included. Linde Air Products Company will also display flame-priming and flame-gouging equipment. A portable powder-cutting setup will be shown. Also included will be items of standard oxy-acetylene apparatus and accessories.
Personnel: H. H. Bassett, The Linde Air Products Company, and R. L. Lerch, Haynes Stellite Company.
Tulsa address: National Bank of Tulsa Building.

● **Union Chain and Manufacturing Co.**
Sandusky, Ohio
California Building, Booths 37 and 38
Exhibit: Oil field chains, machine finished roller chain, sprockets, silent chains, silent chain flexible couplings, and roller chain flexible couplings.
Personnel: E. F. Emmons, E. P. McCune, Richard Mullaney, John Castleberry, and Cliff Pilkey.

● **Union Tank and Supply Company**
Houston, Texas
Block "H"
Exhibit: Oil and gas separators, bolted steel tanks, heaters, aluminum buildings, steel derricks, and welded steel tanks.
Personnel: G. G. Byer and L. J. Dorsey.
Tulsa address: 523 Petroleum Building.

● **Union Wire Rope Corporation**
Kansas City, Missouri

Republic brings you

wire rope service

Republic

BRINGS YOU THESE LEADING DRILLING EQUIPMENT LINES

- Abegg & Reinhold Company, Ltd.
- American Iron & Machine Works
- American Chain and Cable Company
- Baash-Ross Tool Company
- Baker Oil Tools, Inc.
- Byron Jackson Company
- Cameron Iron Works, Inc.
- Chain Belt Company
- Clark Bros. Company, Inc.
- Fairbanks, Morse & Company
- Foster Cat Head Company
- Gardner-Denver Co.
- Hughes Tool Company
- International Derrick & Equipment Co.
- Larkin Packer Company
- Link-Belt Company
- McKissick Products Corporation
- McNeely Materials Company
- Mission Manufacturing Company
- Oil Center Tool Company
- Patterson-Ballagh Corporation
- Parid Division of Tretolite Co.
- Rector Well Equipment Company
- Reed Roller Bit Company
- Republic Steel Corporation
- Shaffer Tool Works
- Spang Chalfant Division
- Unit Rig & Equipment Co.
- W-K-M Company
- Wall Rope Works
- Waukesha Motor Company
- Wilson Manufacturing Co., Inc.

You learn a great deal from individual service records about the efficient performance, the low average cost of Roebling "Blue Center" Steel Wire Rope. But records tell you only part of the story . . . of its toughness, its reserve strength, its basic dependability under all conditions of operation.

What makes "Blue Center" a rope you can choose with full confidence? The Roebling reputation, for one, and the superior Roebling-made steel in the wires.

There's the skill born of over a century's experience that goes into the rope's fabrication, the modern, unsurpassed facilities used.

Add to the never-ending research that gives you longer rope life, the practical engineering that assures the best rope for your purpose.

Remember those facts when you order — through Republic Supply — the product of America's first wire rope maker.

DEPENDABLE

Whether it is wire rope you need, or any of the thousand-and-one other items required in oil and gas operations, you can depend on REPUBLIC to bring you the best from the industry's leading manufacturers.

Remember, REPUBLIC manufactures no specialties of its own and therefore is free to perform the true function of a supply service . . . to select and stock only the best product for every type of service.

This is why we can say: "Make REPUBLIC *Your Supply Store*," and always be assured of getting

EVERYTHING BEST IN PRODUCTS AND SERVICE

•

Roebling Wire Rope is one of the many lines of distinguished products associated with Republic Supply Service.

Republic Supply COMPANY

GENERAL OFFICES · · · HOUSTON 1, TEXAS

REPUBLIC STEEL

Republic

SERVES YOU FROM THESE POINTS

ARKANSAS
El Dorado, Patmos

•

COLORADO
Denver

•

ILLINOIS
Chicago, Grayville, McLeansboro, Salem

•

KANSAS
Ellinwood, Russell, Wichita

•

LOUISIANA
Haynesville, Lake Charles, Mamou, New Iberia, Rodessa, Shreveport

•

MISSISSIPPI
Jackson

•

NEW MEXICO
Artesia, Hobbs

•

OKLAHOMA
Bartlesville
Cement, Oklahoma City, Seminole, Tulsa

•

TEXAS
Abilene, Alice, Big Spring, Borger, Columbus, Corpus Christi, Dallas, Electra, Falfurrias, Fort Worth, Hebbronville, Houston, K-M-A, Kennedy, Kermit, Kilgore, Nocona, McAllen, Monohans, Odessa, Olney, Pampa, Pleasanton, San Antonio, Sundown, Talco, Victoria, Wichita Falls.

•

General Offices
Houston, Texas

Texas Building, Booths 80, 81, 82, 129, 130, and 131

Exhibit: Electric train showing how wire rope is moved from the fabricating mill to the different fields of use.

Personnel: M. B. Hansell, Sr., and Ray G. Noble.

Tulsa address: Company office at 401 Beacon Building.

● **United Chromium, Inc.**
New York, New York
Texas Building, Booth 126

Exhibit: Corrosion-resisting Ucilon protective coatings.

Personnel: O. G. Underwood and J. A. Williams.

● **United States Steel Corporation**
Pittsburgh, Pennsylvania
Oklahoma Building, Booths 136 to 148, inclusive

Exhibit: Combined exhibit of products and services of United States Steel Corporation Subsidiaries. One exhibit will show how U.S.S. Stainless Steel can be formed into sections frequently used in the petroleum industry, with actual demonstrations of bending, forming, and shearing stainless steel strip, bar, and tubular stock, forming angles and other shapes and then bending them as might be required. Other stainless steel exhibits will show actual applications of this versatile steel in the petroleum industry, while additional display material will give the visitor salient facts and useful information regarding the application of the other types and grades of alloy and carbon steels made by Carnegie-Illinois Steel Corporation, Columbia Steel Company, and Tennessee Coal, Iron & Railroad Company, whose special tool steels will also be included for study and examination.

A tubular exhibit will illustrate and demonstrate the application and properties of National Tube Company products such as drill pipe, casing, tool joints, oil well tubing, line pipe and refinery still tubes. A special feature will show the underground gas storage units using 40-ft sections of 24-in. seamless tubing fabricated into containers that are manifolded for use in supplementing regular natural gas supply.

American Steel & Wire Company will present in a compact display a complete exhibit of the special American Tiger Brand wire rope and cables used in the petroleum industry. The exhibit also will include representative samples of the various electrical wires and cables used around oil rigs and refineries.

Gerrard Steel Strapping Company will exhibit one of its line of special wire strapping machines, and United States Steel Supply Company will make available for inspection a series of the specialties they handle particularly for the petroleum industry.

Photographs will illustrate the barges and structures of various types that American Bridge Company fabricates for producers and refiners. Similarly, the Cyclone Fence Division of American Steel & Wire Company will be represented by samples of their various products with detailed literature describing types and applications.

Cooperating in this display will be the following: American Bridge Company, American Steel & Wire Company, Carnegie-Illinois Steel Corporation, Columbia Steel Company, Cyclone Fence Division of American Steel & Wire Company, Gerrard Steel Strapping Company, Tennessee Coal, Iron & Railroad Company, United States Steel Export Company and United States Steel Company.

● **United Supply and Manufacturing Company**
Tulsa, Oklahoma
California Building, Booths 28 and 29

Exhibit: United pumping units equipped with Waukesha oil field power units.

Personnel: H. B. Gutelius, Frank Wood, G. E. Wiley, James L. Smith, Charles G. King, Jr., W. T. Hughes, L. L. Walker, Jr., F. W. Fisher, and A. A. Thieman.

● **Unit Rig and Equipment Company**
Tulsa, Oklahoma
Block 12

Exhibit: Drilling rigs and production hoists

Personnel: T. A. Ramey and Ray Louden back.

Tulsa address: Unit Rig and Equipment Company. Phone: 5-3137.

● **Universal Atlas Cement Company**
Pittsburgh, Pennsylvania
Block 2
See Oil Well Supply Company.

● **Universal Oil Products Company**
Chicago, Illinois
Scientific and Technical Building, Booths 73 and 74

Exhibit: Operating model of fluid catalytic cracking process together with photographs illustrating the typical activities of Universal in research, development, engineering, refinery planning, field service, and inhibitors.

Tulsa address: Mayo Hotel.

● **Van Dorn Electric Tool Co.**
Towson, Maryland
Texas Building, Booths 38 and 39

● **Vapor Car Heating Co.**
Chicago, Illinois
Block V

● **Vapor Recovery Systems Co., The**
Compton, California
Oklahoma Building, Booths 80 and 81

Exhibit: Operational mock-up of Varec automatic tank guage, operational mock-up of swing line assembly, cut-away section of vapor recovery regulator, cut-away section of nozzle-type angle relief valve, conservation vent unit, pressure and vacuum relief valve, back pressure regulator, vacuum relief valve, gauge and theif hole cover, antifreeze water draw-off valve, internal safety valve, combination conservation vent valve and gauge hatch, and sampling bottle cage.

Personnel: Frank V. Long, John L. Shaunty, A. D. Scotty, and William Worsham.

Tulsa address: 533 Mayo Building. Phone: 2-4243.

● **Vickers Incorporated**
Division of Sperry Corp.
Detroit, Michigan
Block 3

Exhibit: Vickers 18-ft stroke hydraulic pumper, hydraulic steering booster, hydraulic power pack, hydraulic cargo winch, and variable speed hydraulic transmission.

Personnel: F. T. Harrington, O. G. Houser, R. E. Esch, J. Robinson, E. Heath, J. W. Kelley, E. LeCorgne, W. Driver, B. L. Readman, J. R. Moser, and H. E. Payne.

● **Victaulic Company of America**
New York, New York
Texas Building, Booth 90

Exhibit: Victaulic pipe couplings, full-flow elbows, tees, and fittings, portable pipe tools, Roust-a-Bout pipe couplings.

Personnel: M. C. Hutchinson, R. W. English, A. G. Baldwin, and G. N. LaMont.

● **Victor Equipment Co.**
San Francisco, California
Oklahoma Building, Booths 189 and 190

● **Viking Pump Company**
Cedar Falls, Iowa
California Building, Booth 57

Exhibit: Rotary pumps.

Personnel: Stanley A. Petersen and M. L. Calvert.

Tulsa address: % Warner Lewis Company.

● **Visco Products Company, Inc.**
Houston, Texas
Kansas Building, Booth 73

Exhibit: Display of 55-gal metal containers

Personnel: D. M. Jacks, Fred E. Cochran, J. C. Bell, Earl E. Ferguson, Dr. W. H. Kirkpatrick, L. P. Howze, S. W. Gray, R. W. Loftin, A. C. Smith, C. F. Spangler, and F. H Thorne.

Tulsa address: Bliss Hotel.

● **Vortox Manufacturing Company**
Claremont, California
Block J and West of Block U

Exhibit: See The Happy Company.

● **Wagner Electrical Corporation**
St. Louis, Missouri
California Building, Booths 35 and 36

● **Wahlberg-McCreary**
Houston, Texas
Block 3

● **Wall Rope Works, Inc.**
New York, New York
Texas Building, Booth 27

Exhibit: Oilfield cordage, manila drilling cable, catlines, spinning lines, derrick lines, and an experimental rope.

● **Walworth Company, Inc.**
New York, New York
Oklahoma Building, Booths 103-108

Exhibit: Pipe line valves both cast steel gate valve and lubricated plug valves, Bronze valves, steel valves, pressure-seal gate valves, flow line valves, iron body valves, and pipe fittings.

Personnel: A. J. Eichler, J. D. McManus, W. M. Combs, E. L. Clark, C. G. Finkle, H. C. Nannen, L. F. Lamberty, John Rice, J. G. Younggren, W. H. Weber, F. S. Markle, R. S. Fraysier, Joe Kaye, E. B. Marrs, and W. C. Wadsworth.

● **Warner Lewis Company**
Tulsa, Oklahoma
California Building, Booth 59

● **Watson-Stillman Company**
Roselle, New Jersey
Oklahoma Building, Booths 223 and 224

Exhibit: Portable hydraulic pipe bender, hydraulic pump and jack, 30-ton laboratory press, and 1-oz injection molding machine.

Personnel: A. G. York, J. P. Bittenbinder, C. Johnson, and T. L. Moore.

Tulsa address: Alvin Hotel.

● **Waukesha Motor Company**
Waukesha, Wisconsin
Block J

Exhibit: Diesel engines for drilling, servicing, pumping and utility plants, gas engine counterparts.

Personnel: J. E. DeLong, J. B. Fisher, J. G. Swain, P. C. Ritchie, A. W. Pope, Jr., E. R. Rutenber, J. R. Merriam, H. J. Lemmer, Eugene Bennett, G. E. Duncan, A. G. Mulkey, John G. Robel, Max Hofmann, W. M. Jacobson, R. T. Crafts, and H. J. Loebl.

● **Weatherford Spring Company**
Weatherford, Texas
Block 105, Booth 9, on Park Lane

Exhibit: Scratchers, spiral centralizers, straight centralizers, cementing baskets, cementing heads, gravel packing centralizers, tong pull-back springs, drill pipe wipers, pipe rack, all-weather delivery and installation unit.

Personnel: J. E. Hall, Sr., J. E. Hall, Jr., and J. A. Hall.

Tulsa address: Mayo Hotel.

● **Weatherhead Company**
Cleveland, Ohio
Scientific and Technical Building, Booth 82

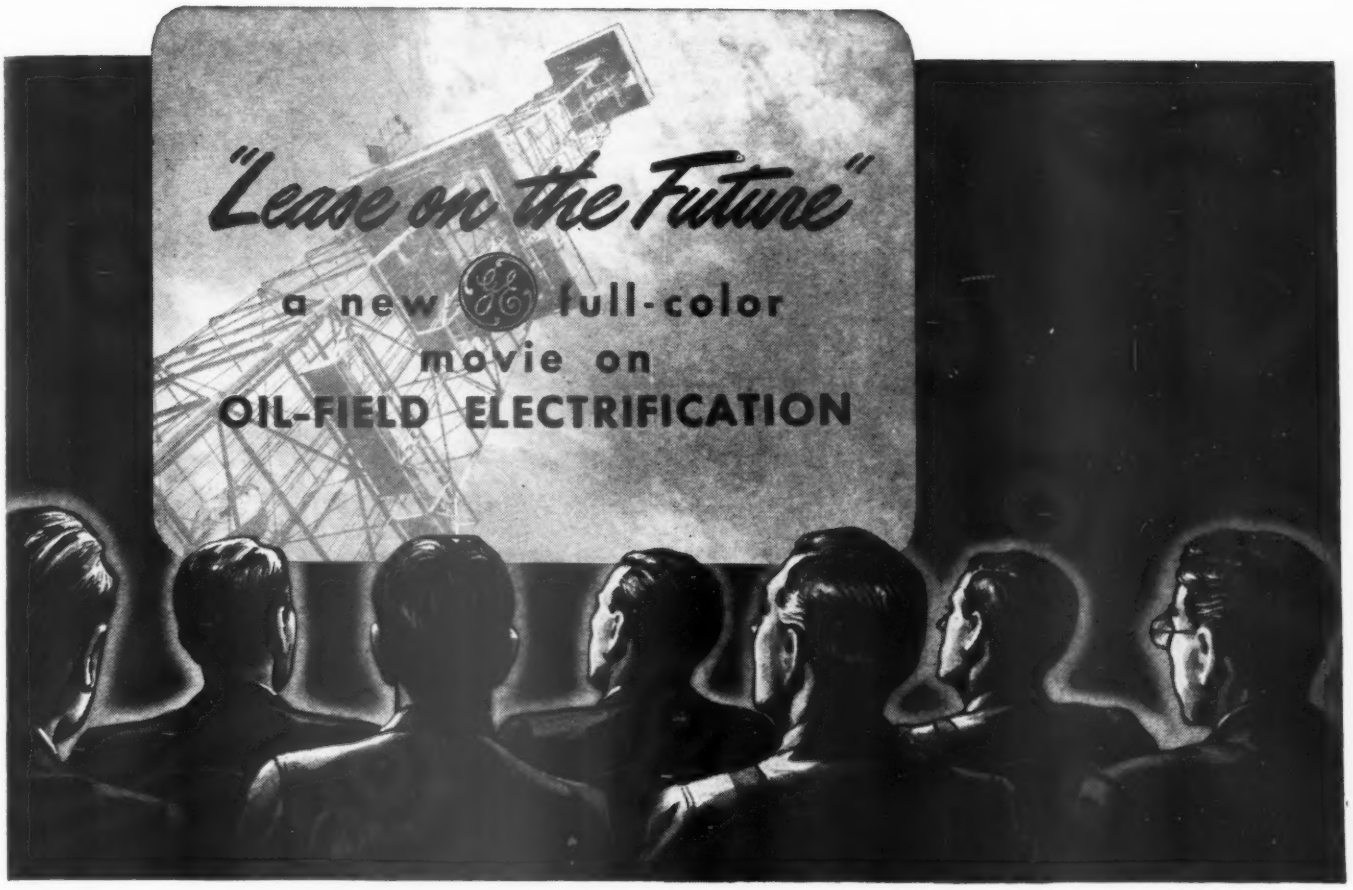
● **Webster Engineering Company**
Tulsa, Oklahoma
Oklahoma Building, Booths 194 and 195

● **Web Wilson Oil Tools, Inc.**
Huntington Park, California
Oklahoma Building, Booths 187 and 188

Exhibit: Side door elevators, center latch drill pipe and tubing elevators, rotary tongs, elevator links, drilling connectors, tong dies, and tong pins.

Personnel: W. W. Wilson, W. A. Wilson, and B. M. Landis.

SEE IT NOW!



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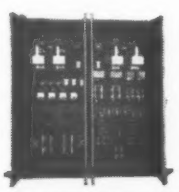

Main parts of a D-c Drilling Rig Drive
Main D-c Generators (Upper Left) supply power for draw-works, rotary and mud-pump motors. May be engine- or motor-driven.
Main Controls (Above), consisting of necessary control and transfer switches, relays and other devices.
D-c Motors (Left), are powered by generators. They drive draw-works, rotary table, etc., through speed-reducers.

General Electric Co.
Section B654-74, Apparatus Dept., Schenectady 5, N. Y.

Please send me the following bulletins:

☐ GEA-4456 (Electric Equipment for D-c Engine-Driven Rigs)
☐ GES-3485 (More Oil At Less Cost Electrically)

Name.....
Company.....
Address.....
City..... **State**.....

● **Welderz Frend Generator Company**
Lubbock, Texas
Kansas Building, Booths 32, 33, 34, and 35
Exhibit: With Independent Supply Company.
Tulsa address: Independent Supply Company, 626 East Third Street.

● **Well Equipment Manufacturing Corporation**
Houston, Texas
Texas Building, Booths 102, 103, and 108
Exhibit: Wing unions, blocks, thread compounds, swivel joints, line blinds, plug valves, blow-off valves, loading rack valve, burners, and fusible plugs.
Personnel: G. R. Winder, T. T. Word, Jr., T. R. Shields, and A. S. Bright.
Tulsa address: Alvin Hotel, and 810 South New Haven.

● **Well Instrument Developing Co.**
Houston, Texas
Oklahoma Building, Booth 36
Exhibit: Portable electric logging unit.
Personnel: Hubert Guyod.

● **Well Surveys, Inc.**
Tulsa, Oklahoma
Scientific and Technical Building, Booth 77
Exhibit: Continuous sound color motion picture on "Radioactivity Well Logging."
Personnel: W. G. Green, Chas. E. Duller, Gilbert Swift, R. E. Fearon, J. M. Thayer, E. S. Mardock, Glen Peterson, A. W. Engle, W. G. Ownby, and George Sykora.

● **Westcott & Greis, Inc.**
Tulsa, Oklahoma
Scientific and Technical Building, Booths 45, 46, 57, 58
Exhibit: Orifice meters, positive displacement gas meters, gas regulators, flow controls, differential control valves, air-actuated instruments, all manufactured by the American Meter Company. Safety and relief valves and indicating gages manufactured by Crosby Steam Gage & Valve Company. Gas and oil control regulators manufactured by the Davis Regulator Corporation. Motor diaphragm air actuated control valves manufactured by the Hammel Dahl Company. Gas regulators manufactured by Reliance Regulator Corporation. Orifice fittings manufactured by Robinson Orifice Fitting Company.
Personnel: J. H. Satterwhite, C. C. Clover, and H. W. Wahl.

● **Western Manufacturing Company**
Nowata, Oklahoma
Kansas Building, Booth 36
Exhibit: Water treating machines.
Personnel: Chas. R. Yand.
Tulsa address: 1207 South Gary.

● **Western Sand-Banum Company**
Houston, Texas
Texas Building, Booth 101
Exhibit: Sand-Banum.
Personnel: L. Bradie and Frank J. Welu.
Tulsa address: Hotel Tulsa.

● **Western Supply Company**
Tulsa, Oklahoma
Block 105
Exhibit: Telescopic jacket water cooler, box style atmospheric sections, separable tube sheet atmospheric sections, conventional floating head removable bundle exchangers, and air-fin sections.
Personnel: Paul R. King, E. D. Anderson, and J. E. Hughes.

● **Westinghouse Air Brake Company, Industrial Division**
Wilmerding, Pennsylvania
Park Lane, Booth 3
Exhibit: Pneumatic controls for oil rigs, Controlairs, Relayairs, actuators, and Flexair valves.
Personnel: J. P. Cooper, C. J. Werlich, D. R. Read, and O. W. Schwartz.

● **Westinghouse Electric Corporation**
Pittsburgh, Pennsylvania
Oklahoma Building, Booths 21, 22, 23, 118, 119, 120
Exhibit: All-steel Life-Line motor, an air-break combination linestarter, portable a-c and d-c welders, linestarters and no-fuse circuit breakers, a splashproof Life-Line Gearmotor, a heavy duty speed increasor, a Rectox copper oxide rectifier cathodic protection unit, self protecting transformer, arc-welding electrodes, fluorescent and incandescent lighting equipment including floodlights, and a power factor correction demonstrator.

● **Wheatley Pump & Valve Manufacturers, Frank**
Tulsa, Oklahoma
Block T and E. of Block T
Exhibit: Re-designed increased-speed Wheatley quintuplex pump, driven by 400-hp Le Roi engine, "Pluggate" quick-opening nonlubricated valve, F-9. 1824 V-belt driven economy pump, complete line of Wheatley pumps, check valve, tapping machine, and gasoline and oil strainers.
Personnel: Frank Wheatley, Sr., Frank Wheatley, Jr., Gus Baker, Jr., William Gray, John Burris, Bob Forsman, Tiny Bridges, Glen Taylor, Malcom W. Black, and Fred Crabbe.

● **Wheeling Corrugating Company**
Wheeling, West Virginia
See Steve C. Maples & Co.

● **Wheeling Machine Products Co.**
Wheeling, West Virginia
Oklahoma Building, Booth 22

● **Wheeling Steel Corporation**
Wheeling, West Virginia
Kansas Building, Booth 27
Exhibit: Steel shipping containers.
Personnel: R. L. Brammer, J. E. Boddy, F. E. Hawley, B. M. Sharp, and E. C. Yanda.

● **Wheland Company, The**
Chattanooga, Tennessee

While attending the International Petroleum Exposition, you are cordially invited to visit our exhibit in Booth 168 of the Oklahoma Building.

We shall also be happy to have you inspect our Manufacturing Plant and Foundry in Tulsa.

NELSON *Electric* MANUFACTURING CO.

217 North Detroit — TULSA, OKLAHOMA — Telephone 2-5131

MANUFACTURERS OF:

Explosion Proof Motor Controls
Junction Boxes and Enclosures
Circuit Breakers and Lighting Panels

Oil Field Motor Controls
Automatic Pipe Line Sampling Devices
Cathodic Protection Equipment

Switchboards
Instrument and Control Panels
Unit Substations

Block 1
Exhibit: Pumps, rotaries, swivels, traveling and crown blocks.
Personnel: James C. Blake, W. A. Pitts, Francis C. Awtrey, Ed Lyle, and W. E. Shorts.
Tulsa address: Jones & Laughlin Supply Company.

- **Whitney Chain and Manufacturing Company, The**
  Hartford, Connecticut
  Kansas Building, Booths 74 and 75
  Exhibiting: Oil field assembly chain.
  Personnel: J. W. Anderson, R. G. Atkins, R. W. Johnson, J. F. Rondinone, A. J. Swisler, E. T. Teal, K. R. Weld, and L. H. Whitney.
  Tulsa address: 1232 East 29th Place.

- **Wickwire Spencer Steel Division, Colorado Fuel & Iron Corp.**
  Palmer, Massachusetts, and New York, New York
  Oklahoma Building, Booths 109 and 119
  Exhibit: Wire rope.
  Personnel: C. F. Lanter, L. S. Helms, E. J. Daly, J. P. Hanks, R. J. Jones, E. L. Klingler, and A. S. Rairden.
  Tulsa address: Company office at North Rockford and Frisco Tracks. Phone: 5-1281.

- **Wico Electric Company**
  Springfield, Massachusetts
  Texas Building, Booths 109 and 110

- **Wiggins Vapor Seals Division, General American Transportation Corp.**
  Chicago, Illinois
  Oklahoma Building, Booths 5 and 6
  Exhibit: Display featuring operation of Wiggins Dry Seal Gasholder in conserving vapor losses. Floating roof and the dry seal lifter roof tanks.

- **Wilkening Manufacturing Company**
  Philadelphia, Pennsylvania
  Park Lane, Booth 10

- **Willard Storage Battery Company**
  Cleveland, Ohio
  California Building, Booth 34
  Exhibit: Batteries.
  Personnel: R. N. Alexander.

- **Williams Brothers Corporation**
  Tulsa, Oklahoma
  Oklahoma Building, Booth 165
  Tulsa address: Phone: 4-3108, 4-3109, 4-3100.

- **Williams & Co., R. C.**
  Wayne, Ohio
  Kansas Building, Booth 126
  Exhibit: Lower valve pullers and subsurface oil well pumps.
  Personnel: R. C. Williams, C. A. Warner, C. S. Vogel.
  Tulsa address: Cadillac Hotel.

- **Williamson, T. D., Inc.**
  Tulsa, Oklahoma
  Oklahoma Building, Booth 156
  Exhibit: Pipe line pigs, casing bushings, pipe line casing insulators, pipe tapping machines, gas pipe line expansion plugs, pipe finders, and leak detectors.
  Personnel: T. D. Williamson and T. D. Williamson, Jr.

- **Wilson Foundry and Machine Co.**
  Houston, Texas
  Oklahoma Building, Booth 59

- **Wilson Manufacturing Company**
  Wichita Falls, Texas
  Blocks R and N
  Exhibit: Titan, rig, Giant rig, Giant single engine rig, Wilson "Mystery Rig," core reel, utility unit, independent rotary table drive, Torcair winches, single and double drum winches, masts, air tube disk friction clutches, spudder, and air-operated friction catheads.
  Personnel: John H. Wilson, A. A. Wilson, B. A. McCullah, Jack Wilson, H. V. Frazee, J. V. Wintle, Jack Ligon, V. M. Ligon, Guy E. Daniels, Earl Markham, and Russell Moore.

- **Wilson Pattern Works, L. C.**
  Coffeyville, Kansas
  Kansas Building, Booth 21

- **Wilson-Snyder Manufacturing Co.**
  Braddock, Pennsylvania
  See Oil Well Supply Co.

- **Wilson Welder & Metals Co., Inc.**
  New York, New York
  Oklahoma Building, Booths 34 and 35

- **Winter Weiss Company, The**
  Denver, Colorado
  Northeast corner of Exposition grounds.
  Exhibit: Portable rotary drilling machine, truck mounted "flat top" water tank.
  Personnel: O. D. Colquitt, O. C. Gossett, H. A. Winter, Jr.

- **W-K-M Company, Inc.**
  Houston, Texas
  Texas Building, Booths 18-21, inclusive
  Exhibit: Production valves, pipe line valves, tubing slips and spiders.
  Personnel: J. D. Rice, E. W. Robinson, V. C. Gallman and T. S. Blanton.
  Tulsa address: Company office at 310 Thompson Building.

- **Wisconsin Motor Corporation**
  Milwaukee, Wisconsin
  Block 4
  Exhibit: Exhibiting with Harley Sales Company.

- **Witte Engine Works Division, Oil Well Supply Co.**
  Kansas City, Missouri
  See Oil Well Supply Co.

- **Wog Valve Company**
  St. Louis, Missouri
  Park Lane, Booth 32

- **Woobank Machinery Co.**
  Tulsa, Oklahoma
  Texas Building, Booths 51-52
  See C. Lee Cook Manufacturing Co.

- **Gar Wood Industries, Inc.**
  Wayne, Michigan
  Skelly Drive, Booth 13
  Exhibit: Buckeye Model 51 ditcher, Buckeye Model 312 ditcher, Buckeye Model 70 power hoe, Gar Wood HD 101 Dozecaster and Model 106 winch on Allis-Chalmers Model HD 10 tractor, Gar Wood Model CT-Tipdozer on Allis-Chalmers Model HD-19 tractor, complete line of truck winches, and 1050-gal. marketer oil tank.
  Personnel: A. C. Berg, R. D. Hiller, and E. D. Wallace.

- **Worthington Pump and Machinery Corporation**
  Harrison, New Jersey
  Block 9
  Exhibiting: Diesel engine with turbo-charger connected to electric generator, Variflo reciprocating pump, power pumps, Hivol steam pumps, rotary pumps, pipe line centrifugal pump, refinery centrifugal pump, Worthite pump, regenerative pump, model of new mechanical seal, multi-V-drive display, Sterling air compressor, garage type compressor, air conditioning unit, Freon compressor, centrifugal propane compressor, portable compressor, contractor's pump, trailer mixer, air tools, S2R turbine with E6 gear.
  Personnel: E. J. Schwanhausser, J. V. Jirasek, F. J. Ellis, G. F. Habach, A. M. Tullo, E. F. Wright, J. Charles, W. B. Strong, W. E. Wechter, P. A. Mack, T. J. Kehane, H. Garner, H. Boteler, A. C. Ross, G. Steven, and J. J. Ball.

- **Wright Hoist Division, American Chain & Cable Co.**
  York, Pennsylvania
  Oklahoma Building, Booth 158
  Exhibit: Electric hoists, high speed hoists, and trolleys.
  Personnel: S. J. Woodworth and D. R. Smith.

- **Young Engine Corporation**
  Canton, Ohio
  Block A
  Exhibit: Gas drilling engine, electric light plant, under-road boring machine, and model 6 spudder.
  Personnel: W. T. Young, A. E. Avers, and P. A. Foster.

- **Young Radiator Company**
  Racine, Wisconsin
  Block J and West of Block U
  Exhibit: See the Happy Company.

- **Youngstown Sheet and Tube Co.**
  Youngstown, Ohio
  Continental Building, Drake Drive
  See Continental Supply Company

- **Zink Company, John**
  Tulsa, Oklahoma
  Silver Lane, Booths 3 and 4
  Exhibit: Standard refinery burners, floor furnace, unit heater, air heater, steamizer oil gun.
  Personnel: John S. Zink, W. J. Combs, R. D. Reed, and J. Arthur Moore.

☆ ☆ ☆

American motorists pay an average of 23 cents per gallon for gasoline, of which over 6 cents is tax. Motorists in other countries of the world pay as much as 71 cents. In Athens, Greece, gasoline costs 62 cents per gallon; in France 63 cents; in Paraguay, South America, 65 cents; in Sweden 43 cents; and in Moscow, Russia, the price of gasoline is over 71 cents per gallon. Most foreign countries have a rationing system.—*The Petroleum Data Book*, Dallas, Texas.

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Enough B & W Wall Cleaning Guides to give you a good cement job cost only 1/10th as much as any squeeze job.

DON'T SQUEEZE!
It Can Be Avoided.

BRUCE BARKIS — B and W INCORPORATED — KENNETH WRIGHT
Well Completion Specialists
HOUSTON, TEXAS • LONG BEACH, CALIF.

GREATEST DEVELOPMENT IN W

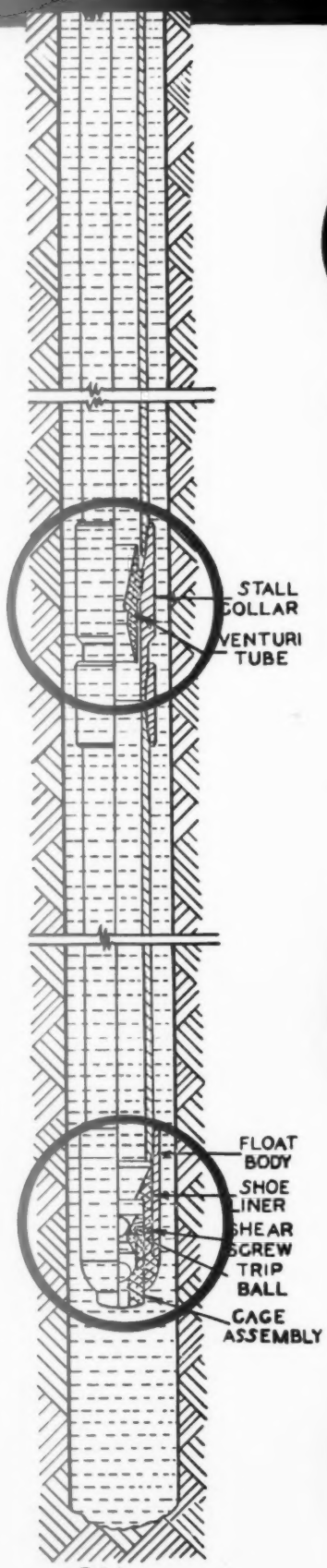


FIG. 1

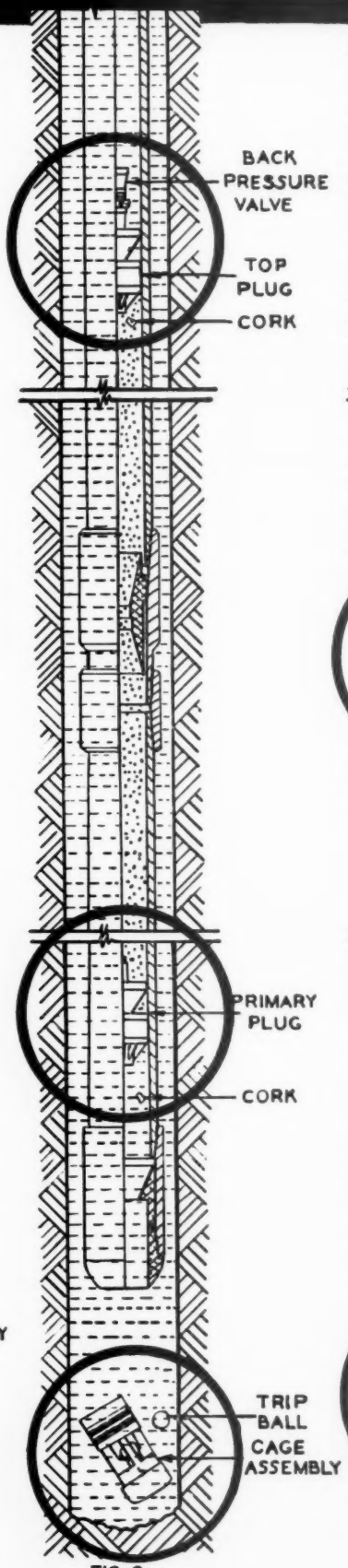


FIG. 2

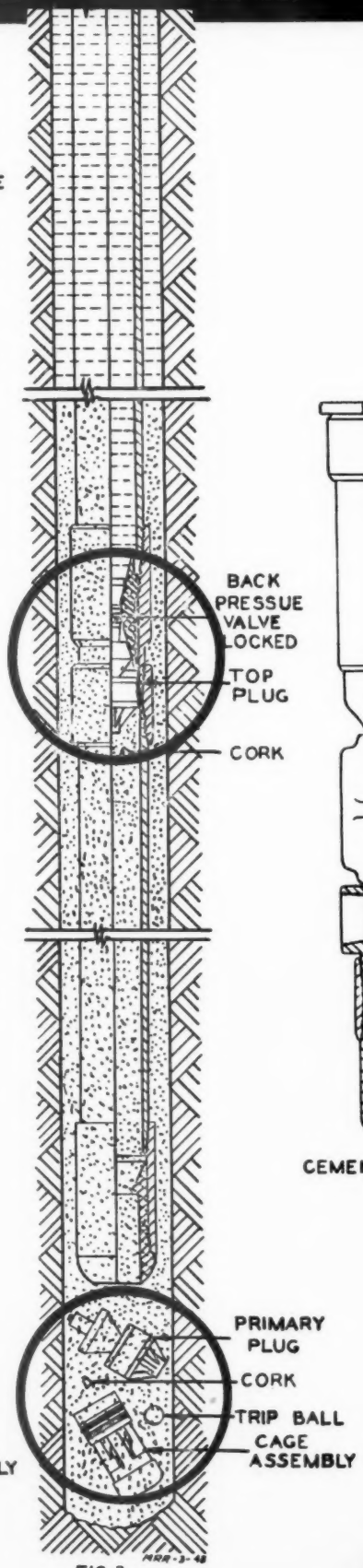
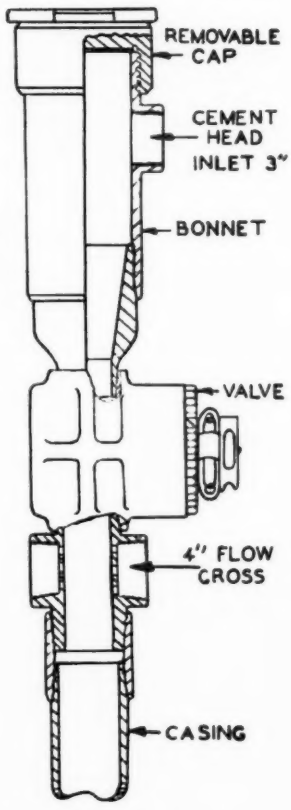


FIG. 3



CEMENTING HEAD

The operating principle of the Rector "Fulbore" Cementing Method is illustrated by the above drawings. Fig. 1 shows the Float Shoe Assembly partially ejected from the casing string by trip ball method. Location of the Stall Collar above the Float Shoe is determined by the quantity of cement to remain in the casing. Fig. 2 shows the cement confined between the cementing plugs. Fig. 3 shows the primary plug discharged from the casing string with the metal back-pressure piston valve, conveyed by the top plug, anchored non-retractably, in the venturi tube of the stall collar. Fig. 4 shows the Cementing Head used to induct the cementing plugs into the casing flow stream under pressure without the necessity of pump shut-down. All casing bore equipment is drillable.

Note: Float Shoe shown in these illustrations is 7" size.

N WELL CEMENTING HISTORY

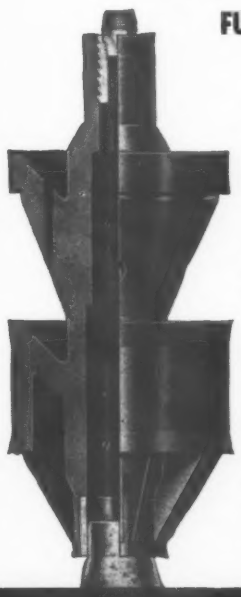
RECTOR FULBORE CEMENTING METHOD

1. FULL CASING BORE DISCHARGE permits greater volumes to be pumped at lower pressures. Also provides higher annulus velocities for scratching, as well as slurry flow.
2. NO AIR POCKETS IN CEMENTING FLOW CIRCUIT.
3. POSITIVE FLUID SEGREGATION BY PISTON SEALING PLUGS.
4. NEW TYPE CEMENTING HEAD constricts and "flows" collapsible cementing plugs into the casing string under pressure, without any flow stoppage in the pumping circuit.

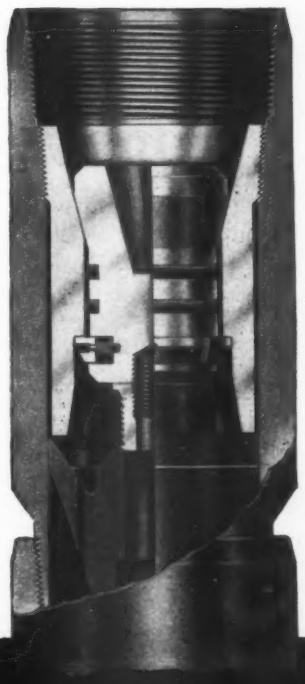
SEE OUR EXHIBIT AT THE INTERNATIONAL OIL EXPOSITION, TULSA, MAY 15 to 22. Booths 20 and 21. OKLAHOMA BLDG.

IT'S NEW!

FULBORE COLLAPSIBLE PLUG



The cork which seals this water-filled cementing plug, is forced out to discharge a quantity of the water when the plug is constricted through the cementing head. Refilling occurs, and assists plug reforming in the casing, by suction caused by previous discharge under submergence. Noncompressible elements of rubber and water provide rigid plug structure when pressured, though having the capability of deforming and reforming.



RECTOR WELL EQUIPMENT CO., INC.

P 615.92

The products pipe line from Houston to Arlington, Texas, constructed for Sinclair Refining Company by H. C. Price Company snakes over a gentle rise. In the particular area where this photograph was taken the terrain was of a rolling nature.

New products pipe line from Gulf Coast

By FRANK H. LOVE, *Managing Editor*

EXCLUSIVE

WHEN shortages of petroleum products developed last winter in certain areas of the country and the inadequacy was properly determined as being caused by lack of transportation facilities, most of the major companies instituted steps, insofar as possible, to correct the situation. That something hadn't been done to avoid the circumstance was due to steel shortages that made line pipe and pumping equipment scarce items. Although line pipe is by no means plentiful even now, the shortage of course is not so acute as during the war and pipe line companies have been able to take up some of the slack and new lines continue to be built.

Sinclair Refining Company is one that has underway an extensive construction program. A part of the system originates on the Gulf Coast of Texas and extends through Southwestern, Middlewestern, and Eastern states as far as Columbus, Ohio. Distribution terminals along the route will make it possible for the consuming public to obtain increased supplies of petroleum fuels.

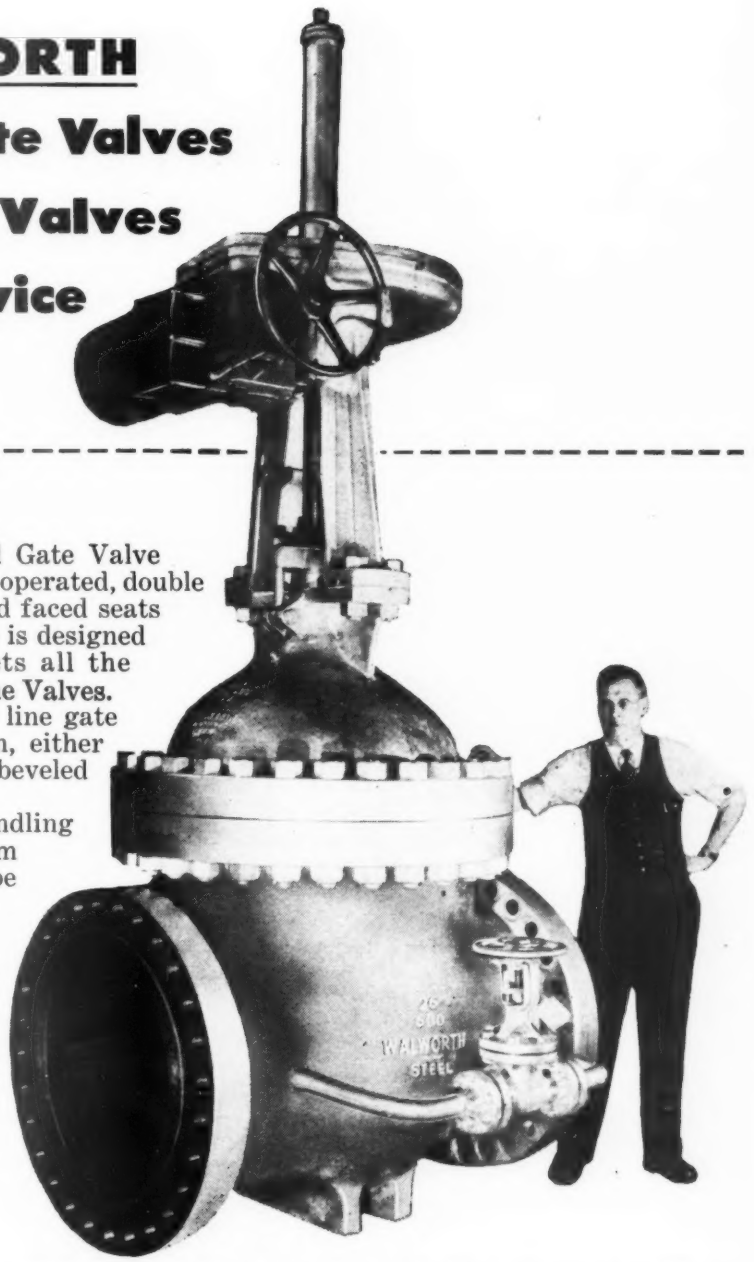
Just completed as a part of this program is a 10-in. line from Sinclair's refinery at Houston to Arlington, Texas, which this article will discuss.

This line, begun late in November, 1947, has been laid under extreme difficult weather conditions, weather that is termed "unusual" even by the out-of-state contractor, H. C. Price Company of Bartlesville Oklahoma. Rain, sleet, or snow were the almost continual lot until the last few weeks of the job, when spring weather gave the construction crews opportunity to finish the 260-mile project with a slightly better feeling toward the elements that had been such austute enemies throughout.

Some of the accompanying photographs show the muddy condition that prevailed during a considerable part of the work. Many trucks and other items of mobile equipment had to be towed by tractor and winch line and, as there

WALWORTH

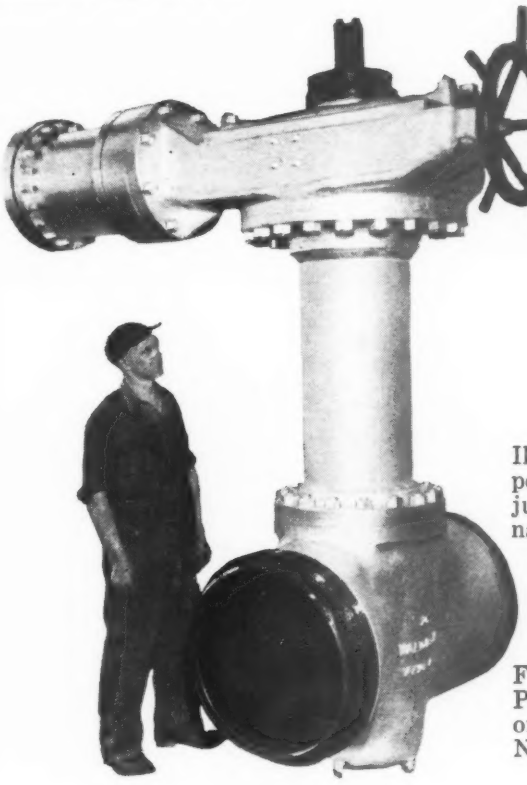
manufactures both Gate Valves and Lubricated Plug Valves for pipe line service



The Walworth 26-inch Series 600 Cast Steel Gate Valve shown here is for pipe line service. It is a motor operated, double disc, parallel seat type of gate valve with hard faced seats and discs; flanges faced and drilled. The valve is designed for 1200 psi working pressure — and meets all the requirements of API Standard 6-D for Pipe Line Valves.

In addition to motor operated valves, pipe line gate valves are available for handwheel operation, either direct or through single or double enclosed beveled gears.

Walworth Pipe Line Gate Valves are handling crude oil, fuel oil, gasoline, and other petroleum products in many of the most important pipe lines of the world.



In addition to double disc cast steel pipe line gate valves, another popular valve for pipe line service is the Walworth Lubricated Plug Valve.

Illustrated is a Walworth 26 by 24-inch Lubricated Plug Valve for 960 pounds working pressure, with a high pressure cylinder for use in conjunction with automatic valve control. Manufactured for service on a natural gas pipe line.

- Made of cast steel and conforms to API Standard 6-D for Pipe Line Valves.
- Roller bearings permit easier opening under pressure.
- Tight sealing — resistant to wear and corrosion — dead tight shut-off — pressure sealed.

For further information regarding either Gate Valves or Lubricated Plug Valves for Pipe Line service, see your nearby Walworth distributor, or write to Walworth Company, General Offices, 60 East 42nd Street, New York 17, N. Y.

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The firing line welders made the finishing welds by the electric-arc method. Three beads were run plus a half bead as a stripper on each side of the pipe.

is no reason to doubt the word of those on the job, even the tow tractors at times had to be towed.

The contractor used three construction crews to lay the line. All did not begin work at the same time, however. As mentioned, one spread started the latter part of November. Another crew got underway just before Christmas, and a third spread shoved off late in January.

The spread of which R. K. Shivel was superintendent (Gang No. 2) began laying pipe near Houston, the southern terminus, and worked north to a point close to Navasota. This spread was the first to complete its part of the line. Due to quicksand almost all ditch on this section had to be cleared of caving sand with backhoes and clamshells.

Gang No. 3, of which W. B. Williams was superintendent, began work at Navasota and finished at a point about three miles north of Elm Mott, near Waco. Between Bryan and Navasota quicksand was again bad, necessitating "clamming out" the caving ditch.

Hot enamel coating was applied to a thickness of 3/32 in. The wrapper shown here is of glass fiber. Asbestos felt also was used.

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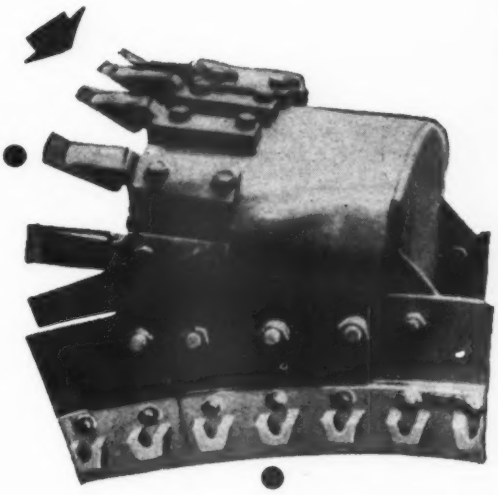
"that really dig"

H & L Teeth ATTACHED TO *TRENCHER* BUCKET



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- Quickly changed, using only a hammer and punch.
- Positive lock, no bolts or pins needed.
- Do not rattle off.
- Points stay sharp, no reversing.

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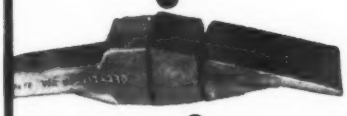
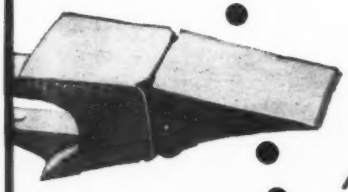
ER & POINT

TRENCHER
SHANK & POINT



L, HOE & DRAGLINE
STAKE TYPE
HANK & POINT

DRAGLINE & BACK HOE
SHANK & POINT



SHOVEL & HOE
ADAPTER & POINT

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H&L TOOTH COMPANY • BOX 330 • MONTEBELLO, CALIF.

(Pioneer Manufacturers of Two Part Teeth)

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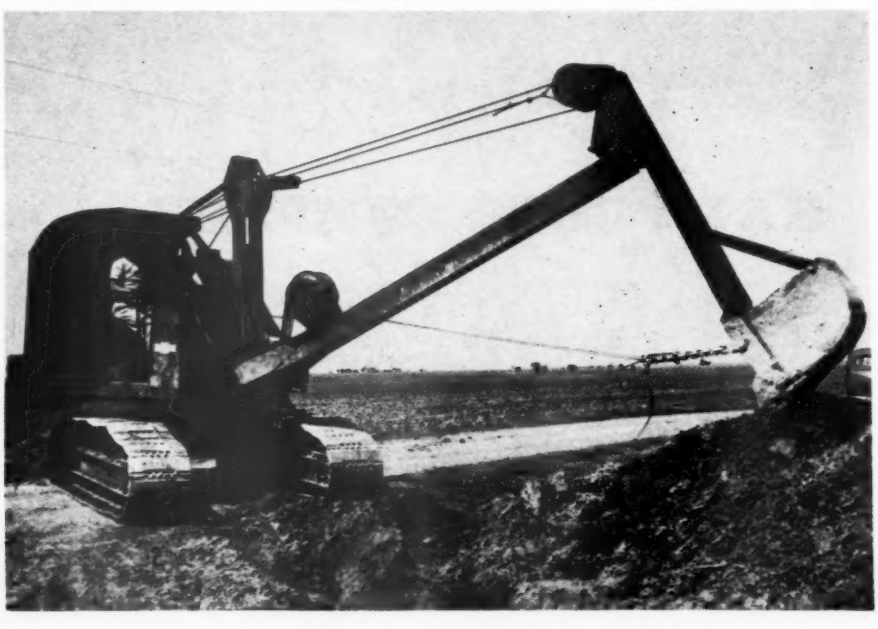
Above—The 10-in. line pipe came in 40-ft random lengths. "Stove-piping" was practiced. Here the sideboom tractors have lined-up a joint of pipe and two welders are making the tack welds. The welding machines are 350 amp.

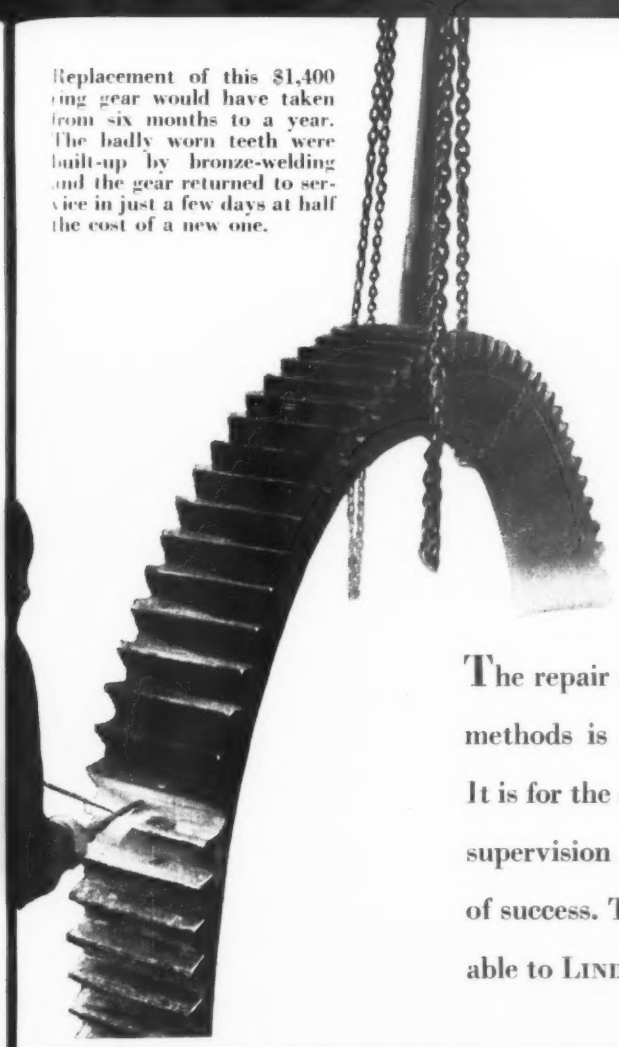
In crossing the Navasota River, 75 ft of pipe was used. This was made up in one section, the pipe flood-coated, lath wired to the pipe for protection of the coating, and the section pulled into place by tractors equipped with winches. On this particular river crossing the pipe was not cased. Two clamps were attached, however, and the pipe was buried 5 ft below the bed of the river.

Gang No. 1, with G. A. Reutzel as superintendent, worked from the Arlington terminal site south to where Superintendent Williams and his crew completed their work. From the outset quicksand was encountered, which extended for a distance of approximately 20 miles. As a matter of fact, terrain and the forces of nature apparently treated all three spreads in about equal manner, that is to say, badly.

North of Arlington about three miles the Trinity River was crossed. This was not a wide crossing as river crossings go—about 50 ft of water and 68 ft of casing—but a procedure was followed that is not always employed. The line pipe was cased with 14-in. casing and the annulus was filled with concrete. Vents were provided on each end of the pipe and concrete was pumped into the vent at one end until it emerged from the other, showing the space between line pipe and casing to be filled. The only possibility of difficulty in such an operation is that the concrete may harden before the space is filled. In this instance the concrete mix was of the correct consistency and the operation was

Below—A backhoe digs the ditch for a road crossing in the construction of the Sinclair products line. Usually such crossings were bored but on this particular day the boring equipment had broken down. Backhoes of this kind were used extensively as the line was laid to clean out caving ditch, which was a real problem due to many areas containing quicksand. The operator of the backhoe, whose face is obscured by the shadows, is W. B. Ward.

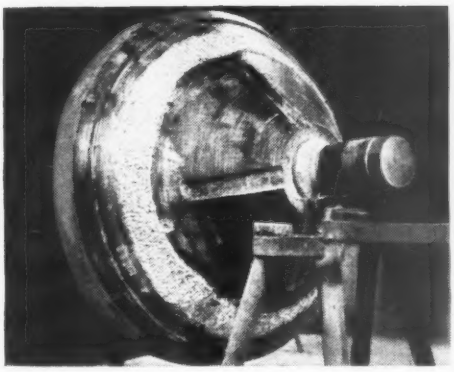




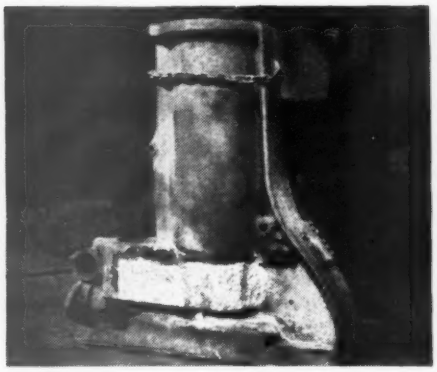
Replacement of this $1,400 ring gear would have taken from six months to a year. The badly worn teeth were built-up by bronze-welding and the gear returned to service in just a few days at half the cost of a new one.

Keeping the "wheels" going 'round

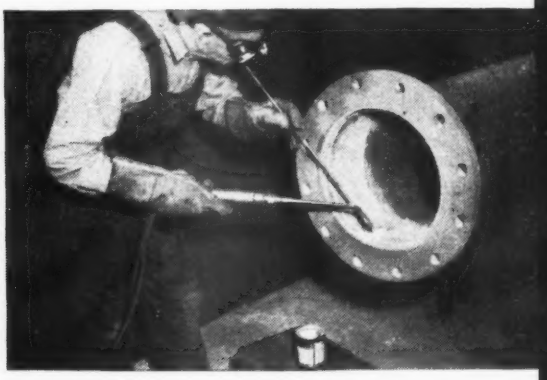
The repair of vast quantities of equipment by oxy-acetylene methods is of course routine for plant maintenance crews. It is for the special job, however, that the LINDE serviceman's supervision and work proves so valuable and gives assurance of success. This skilled, specialized assistance is always available to LINDE customers. Just phone the nearest LINDE office.



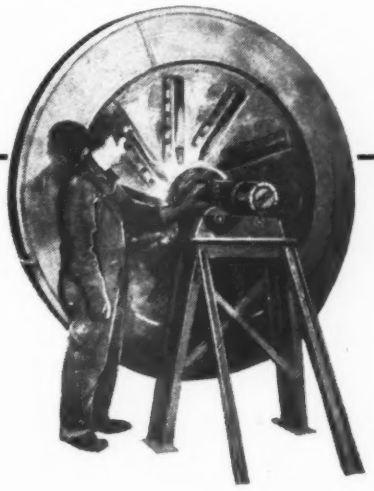
Bronze-welding this cast steel cone crusher head saved $1,000. The crack, which ran completely around the head for a distance of 9½ ft., extended through the thickness of the casting in several places. It was veed out by flame-gouging.



This cast iron steam hammer cylinder weighs 4,000 lb. Two large cracks, one on each side of the cylinder wall, were bronze-welded in only 14 hours. A new casting would have taken 16 weeks to obtain and would have cost more than 10 times as much.



Flanges are quickly joined to cast iron pipe sections by bronze-welding. LINDE supplies several bronze rods to meet varying service requirements.



Bronze-welding effected a considerable saving of cost and time when four spokes of this huge cast iron pulp-chipper wheel was cracked at the hub.

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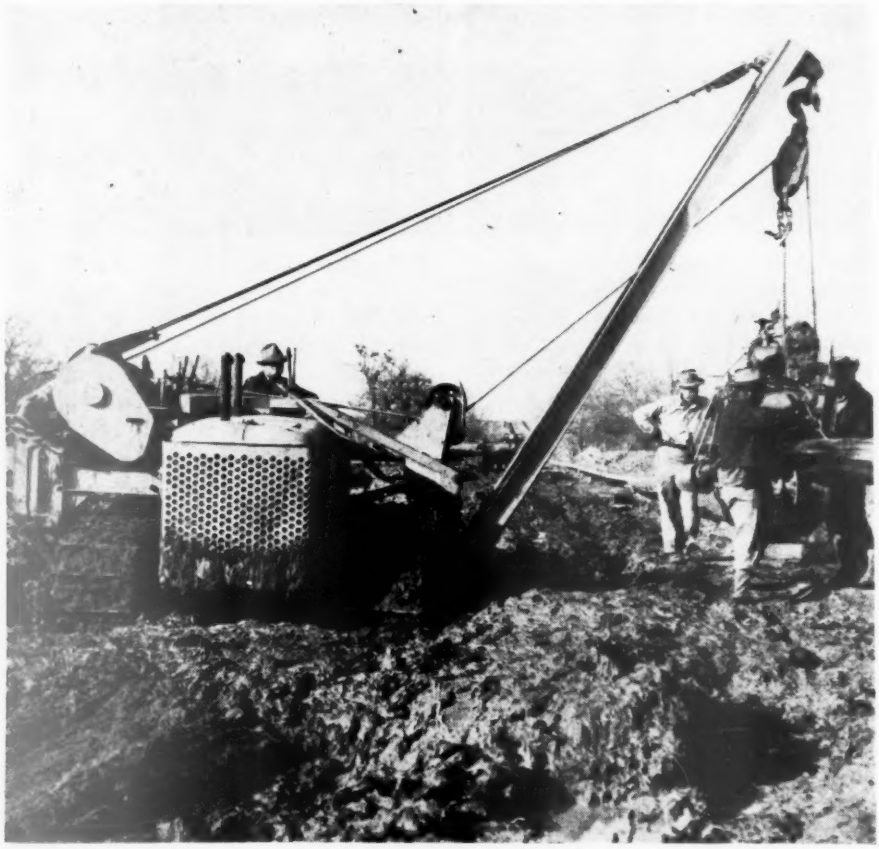
The previous photographs were taken when the line weas nearing completion and the ground was reasonably dry. Earlier, however, rain, sleet, and snow were serious obstacles. The operating difficulties are apparent in these two views; all types of mobile equipment had to be towed.



successful. The pipe was thus given added protection against corrosion and, of course, sufficient weight was provided to make clamps unnecessary.

Other water crossings on the north section were of Hackberry Creek, which was crossed in three places. In two instances the pipe was cased and the annulus filled with concrete. 50 ft of casing being used in both cases.

Welding of the line was with the electric arc, three beads being run on each joint plus a half bead as a stripper on each side of the pipe. Enamel coating was applied to a thickness of 3/32 in. and wrapper was of both glass fiber and asbestos felt. The pipe line ditch was 38 in. deep and 22 in. wide. All bends were made cold with the use of tractors. The 10-in. line pipe was received in 40-ft random lengths and had a wall thickness of 5/16 in. Highways, county roads, and railroad crossings were cased and vented.

The equipment makeup of each spread, allowing for some variation from day to day as necessity dictated, was as follows: Right-of-way, two bulldozers and two trucks; ditching, two ditching machines, one sideboom towing tractor, one truck, two backhoes, and one clamshell; pipe gang, two sideboom tractors and two trucks; welding, 10 to 12 350-amp welding machines; priming, one cradle and tractor; coating and wrapping, one coating and wrapping machine, two sideboom tractors, and two trucks; lowering-in, two sideboom tractors; backfilling, one backfill machine; clean up, two bulldozers and two trucks.

Terminals for the loading of tank trucks are being constructed at Houston, Bryan, Waco, and Arlington.

C. S. LeNoir, general superintendent, supervised the overall operation for H. C. Price Company. Stringing was subcontracted to Dunn Brothers. Sinclair Refining Company established a construction office in Bryan under supervision of W. W. Baker, who is in charge of all construction work for the company's products department. L. B. Moon was Baker's assistant.

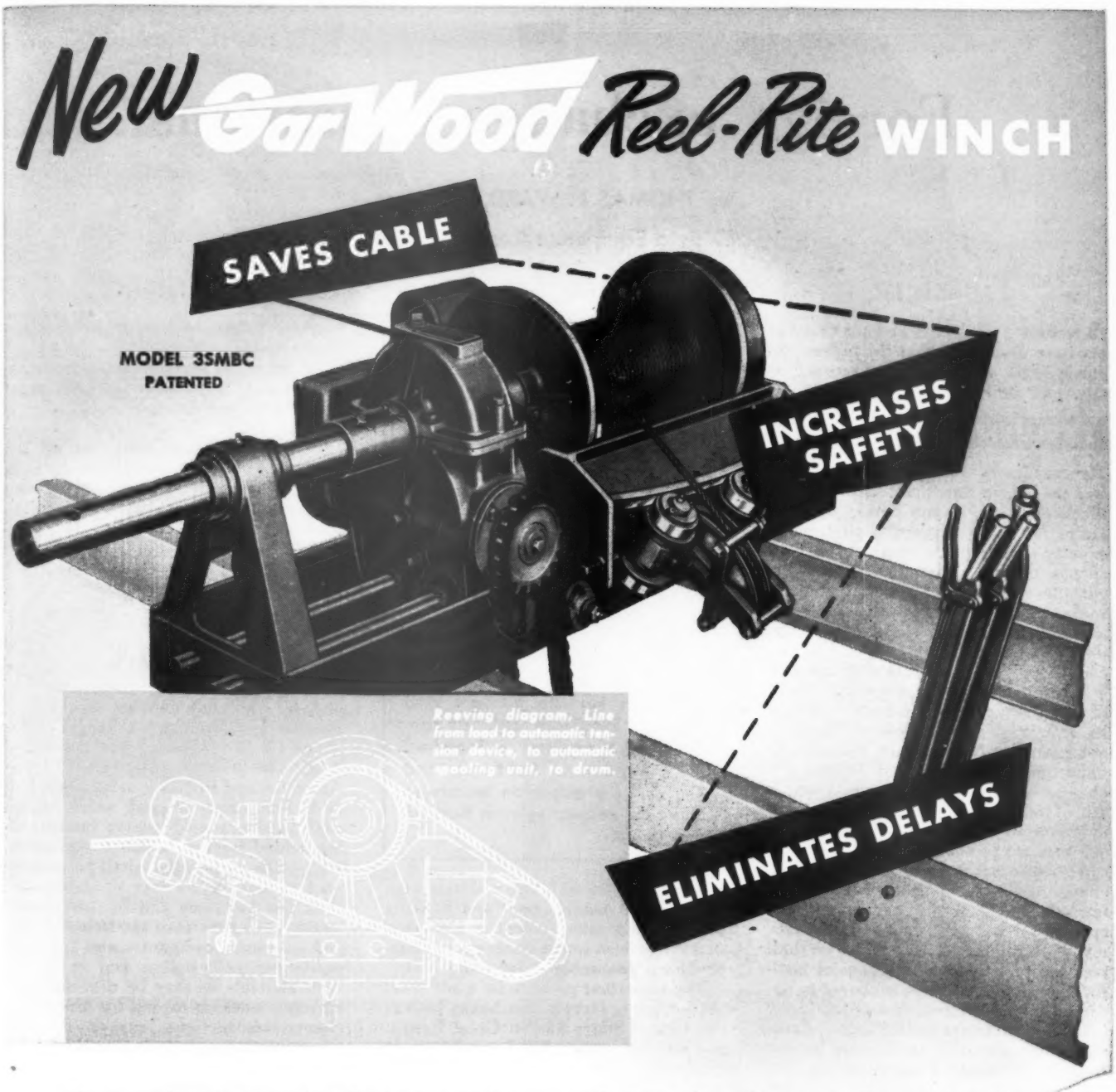
Key personnel for the contractor were as follows:

Gang No. 1—G. A. Reutzel, superintendent; Eddie Yount, office manager; C. S. Sartor, chief mechanic; foreman: Wayne Orr, right-of-way; Lloyd Loncarich, ditch; H. C. Morrison, pipe; Ted Hallmark, welding; S. J. Wood, coating and wrapping; Athel Bell, lowering-in; J. A. Hairston, clean-up.

Gang No. 2—R. K. Shivel, superintendent; R. E. Burgess, office manager; foremen: J. D. White, right-of-way; J. H. Latham, ditch; C. E. Shivel, pipe; R. L. Ezell, welding; G. E. Beavers, coating and wrapping; E. J. Roth, lowering-in.

Gang No. 3—W. B. Williams, superintendent; P. O. Rutledge, office manager; foremen: J. E. Hamilton, and R. H. Edwards, right-of-way; K. K. Kelly, ditch; J. I. Cobb, pipe; C. F. Jones, welding; Rube Owens, coating and wrapping; A. D. Hamilton, lowering-in; Fred Williams, clean-up. ★★★

New Gar Wood Reel-Rite WINCH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Reeving diagram. Line from load to automatic tension device, to automatic spooling unit, to drum.

There are important new benefits for the winch user in the exclusive patented features of the new Gar Wood Reel-Rite Winch. Cut maintenance costs by increasing cable life. Eliminate delays caused by broken cable. Reduce your occupational hazards with a winch that is really safe. Whether slack or under load, the winch line spools on the drum in closely coiled, even layers by being automatically led back and forth across the drum while under automatic tension. No piling up or bunching of coils . . . no loose coils. No crushing of rope or cutting and breaking of strands due to uneven winding.

The Reel-Rite Winch also has the advantages found in other Gar Wood Winches: detachable back draft clutch, automatic safety brake, patented flexible suspension . . . and many more.

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that gives the advantages, operation, dimensions and rating of the new Gar Wood Reel-Rite Winch.

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Foreign exchange operations

By THOMAS E. WARD, *President*
Oilfield Equipment Company, Inc.

EXCLUSIVE

AMERICAN producers and manufacturers have discovered that the biggest obstacle in the way of postwar reconstruction and development of international trade and commerce is the machinery of foreign exchange. The machinery used prior to the recent war no longer functions; like grandfather's clock it has run down. With the aid of American taxpayers, government experts are trying to make foreign exchange machinery function again without the gold mechanism that made it work. It is becoming increasingly clear that gold is the only standard of value that will reconcile the currency of one country with the currency of another.

Whether or not currency and credit of any one country is measured within its own borders by a gold standard, is not immediately important, but what is important in the field of foreign exchange is the determination of a standard of value so that goods and services may flow freely without hindrance from one country to another.

There is no mystery in foreign exchange, it is simply a process of exchanging values expressed in currency of one country for values expressed in the currency of another. Sooner or later we shall face the fact that global financial institutions cannot be safely anchored to paper currencies without links of gold.

Foreign exchange facilities should positively be operated as soundly as the facilities of National and State banking institutions and on a self-sustaining basis. There is no valid reason why the cost of foreign exchange operations should be a direct burden on the shoulders of the taxpayers. No convincing explanation has been heard to account for the present far reaching complications of foreign exchange. These complications are responsible for most of the delay to postwar recovery, and are increasing the heavy burden of taxation by many millions of dollars of unnecessary "paper work."

United States citizens have learned, especially in recent years, the value of sound financial management and sound financial procedure that have been followed by American National and State banks since they were freed from the unbridled speculation that followed World War I. Depositors in American National and State banks have the advantage of a guarantee of their bank deposits. The cost, in part, is made up by depositors not receiving interest on their deposits previously paid by the banks.

The Author

At the request of the editor, the author, who has an intimate knowledge of foreign exchange, has prepared for our readers a discussion of foreign exchange operations, including an outline of the Ward Plan for the sound management and administration of foreign exchange.

As a member of the Council on Foreign Relations and during the war the author rendered valuable service in connection with economic controls. Twenty years ago he initiated and completed negotiations for the Eastern and General Syndicate, Ltd., of London, which resulted in Standard Oil Company of California and Gulf Oil Corporation becoming pioneers, respectively, in Bahrein and Kuwait.

In Great Britain all banks maintain high standards of management and banking practice and management is so sound that it has been found unnecessary to introduce a guarantee of bank deposits.

The important point to be made from the foregoing facts is that banks both in the United States and in Great Britain are soundly managed and stand forth in marked contrast to the deplorable condition of foreign exchange. It is, indeed, possible, under sound banking procedure, freely to convert values expressed in the terms of one currency into values expressed in the currency of another, but to do this we must have sound and constructive management of foreign exchange by men of broad financial vision and experience.

To assure sound management and administration of foreign exchange there is needed:

(1) A sound basis of gold value supporting foreign exchange transfers.

(2) Recognition of the fact that foreign exchange procedure is a banking procedure and should not be confused and confounded by economic theories. In other words, foreign exchange should be operated as soundly and as sensibly as banks are operated in the United States and Great Britain.

(3) Profitable operation of foreign exchange so that instead of "rat hole" expenditures there will be financial benefits for the public generally from government investments in the field of foreign exchange.

As an aid in accomplishing these objectives here is the WARD PLAN as set forth by the author.

I. Capital.

A.—The ultimate source of all the sterling purchased for dollars in the U. S. shall be an international corporation jointly created and adequately capitalized by the American and British governments. The ultimate source of all the dollars purchased with sterling in the U. K. shall be that same corporation operating internationally. Dealers in foreign exchange (the banks of the U. S. and of the U. K.) shall be accountable to the corporation for their sterling or dollar balances (as the case may be) and for the contributions received on purchases of foreign exchange as explained in the following paragraphs.

B.—The capital subscribed by the American and British governments shall be in fine ounces of gold, which capital shall become a gold reserve fund standing behind foreign exchange operations.

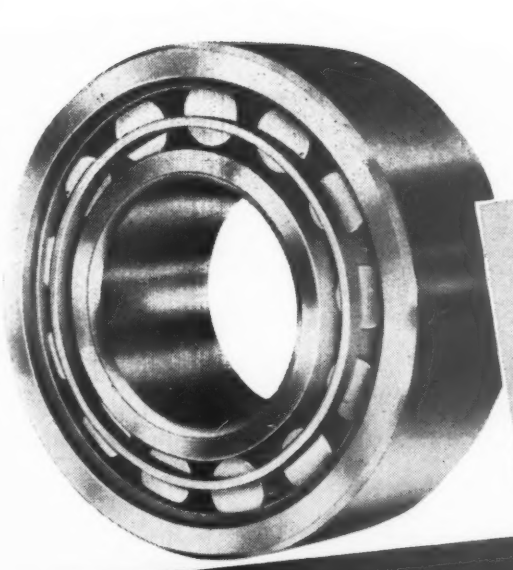
C.—The corporation shall be empowered to borrow by way of debentures from the American and British governments, from American and British banks and insurance companies and from the public generally dollars and sterling in such amounts as may be necessary for currency working capital for foreign exchange transactions between the two countries. Interest shall be paid by the corporation on the amounts of such borrowings at appropriate rates.

II. Operation.

A.—Purchasers of foreign exchange in the United States covering transfer of dollars to sterling and purchasers of foreign exchange in Great Britain covering transfer of sterling to dollars in respect of goods, services, interest, dividends, etc., and for transfers of capital shall make a contribution on each transfer toward the cost of foreign exchange operations.

B.—Purchases of foreign exchange covering transfers of capital shall be permitted only after careful screening by competent authorities such as the Securities Exchange Commission in the United States and the Capital Issues Committee in Great Britain.

C.—The actual percentage to determine the contribution on the amount of foreign exchange transfer (as referred to in paragraph "A" above) shall be fixed by competent financial experts appointed by the Federal Reserve Bank and the Bank of England.



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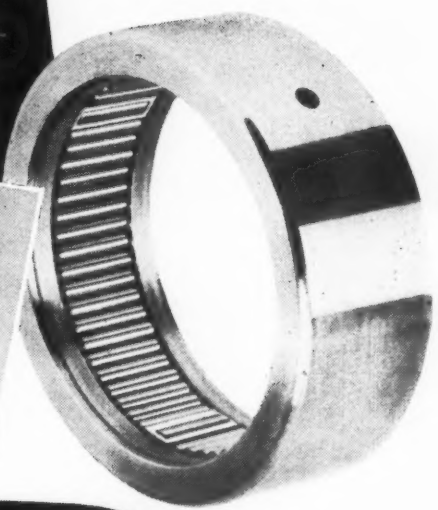

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D.—These contributions shall be in addition to the bankers service charges, which charges should be subject to regulation.

E.—Contributions shall be collected by banks selling foreign exchange and accounted for monthly in the United States through the Federal Reserve Bank in dollars and in Great Britain through the Bank of England in sterling. The Federal Reserve Bank and the Bank of England shall account monthly to the corporation for the contributions as received.

III. Management.

To assure management of the widest possible experience the corporation shall be managed by directors nominated by the Federal Reserve Bank and the Bank of England; the Securities Exchange Commission (U.S.A.) and the Capital Issues Committee of the British Treasury.

IV. Earnings.

A.—Amounts accumulated by the corporation (from the contributions) in excess of repayment of and interest on borrowed capital (used for the purpose of converting dollars to sterling and for converting sterling to dollars) shall be applied solely for purchase of gold to be added to or in replacement of the fixed capital of the corporation.

B.—It might be advisable to use sterling surpluses to acquire gold produced within the sterling area and Canada, and dollar surpluses to acquire gold from other sources, including Fort Knox.

V. Dividends.

A.—Dividends shall be paid to the United States and British Governments, as the stockholders, in gold.

B.—It shall be mutually agreed that the gold so received by the stockholders (American and British governments) shall be used for currency reserves and for reduction of national debts.

VI. Accounting.

A.—The accounts covering subscribed capital, debentures, surplus, dividends, and gold reserves shall be expressed in fine ounces of gold.

B.—The accounts covering foreign exchange transfers and contributions shall be recorded in currencies (dollars and sterling).

C.—The accounts shall be audited annually by a joint international board of auditors.

VII. Rates of exchange.

The corporation shall cooperate with the authorities of the Federal Reserve Bank and the Bank of England in determining stable rates of exchange free from speculation and manipulation.

VIII. Extension of plan to other countries.

The plan first provides for sound operation of foreign exchange between the U. S. and the U. K. and the corporation shall be empowered to extend the advantages of the plan to Canada, the sterling area, France, and to other European countries and to those of Latin America and of the Middle East and Far East.

The example set forth in this plan is stated in terms of foreign exchange transactions between the United States and the United Kingdom. It is also to be noted that the plan can be readily extended to all countries within the sterling area and to all other countries without any fundamental changes.

☆ ☆ ★

The plan has in mind the advantage of correcting aggravated economic conditions by using gold at present sterilized, so that it may benefit the United States, Great Britain, and all trading nations by facilitating operations of foreign exchange. This is an international financial service with merit and advantage for all, without extending unfair advantage to specialists in foreign exchange.

It has become abundantly clear to competent bankers that gold is the only medium for making international settlements for goods and services flowing freely through international channels. The price of gold should be fixed by competent authorities of the United States and Great Britain in dollars and in sterling:

(a) To assure a fair currency value of gold reserves, and

(b) to encourage further production of gold primarily needed to strengthen monetary values nationally and internationally.

It is evident, to those who have thought out the problem of foreign exchange, that international trade and commerce cannot be properly organized without gold reserves behind foreign exchange whether or not gold reserves are at present behind paper currencies. When foreign exchange has a common denominator of gold then a gold basis for all world currencies might be built up to the advantage of all people. There is real danger in our continuing to be led by over-enthusiastic economists into a belief that any government, poor or prosperous, can promote free enterprise solely by the use of paper currencies.

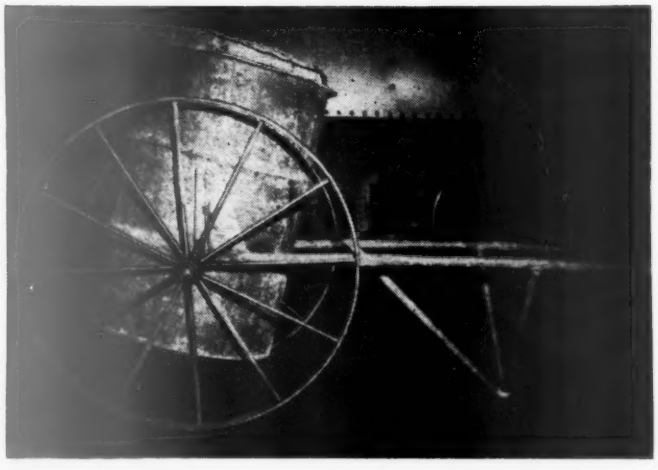
Efforts have continued since the First World War to promote agreements for economic unity, but without a united financial front economic unity cannot be attained.

Unbridled speculations, not only in stocks, bonds, and commodities but also in foreign exchange, followed the First World War. Today speculation in foreign exchange continues centered in currency black markets and extends to illegal transfers of securities. Sound management of foreign exchange under such a plan as that suggested would go a long way to cleaning up this deplorable situation and make possible the transfer of values of goods and services with efficient facility comparable with the facilities available in the banking institutions of the United States for domestic transactions.

The Marshall Plan is now assured and sound business management has been emphasized by the appointment of a practical and experienced administrator. In order to obtain the best results and at the same time to strengthen the domestic way of life, a united financial front is absolutely necessary. The best assurance of world peace and prosperity is the free flow of goods and services from one country to another. This is the object of the Ward Plan for sound management of foreign exchange. ★ ★ ★

Special truck for drums is easily handled

By M. H. PEARCE



One man around the station or warehouse can handle a full 55-gal drum with a special truck. The unit is built on two narrow tired wheels from a fire extinguisher. The stub axles are welded to the 1-in. pipe frame. Two ears or brackets are welded inside the stub axles, each with a ¾-in. pin cut to clear the sides of a drum. On the drum, below the upper roller or ring, are welded special ears. These are shaped like a question mark (?) being set across the drum and with the open sides facing the same way. To pick up a drum, the cart handles are raised until the pins engage the hooked ears. Due to the leverage, a downward push of 40 pounds will lift a 500-pound drum. The drum is released by raising the handle until the support moves forward and brings the drum base flat on the ground.

If the cart is placed as shown, the drum will swing clear, or may be tipped while still suspended in the ears. In the view shown, the cart is being used to pick up the warehouse supply of ice for the drinking water, and is waiting for the train to clear the way across the tracks. ★ ★ ★

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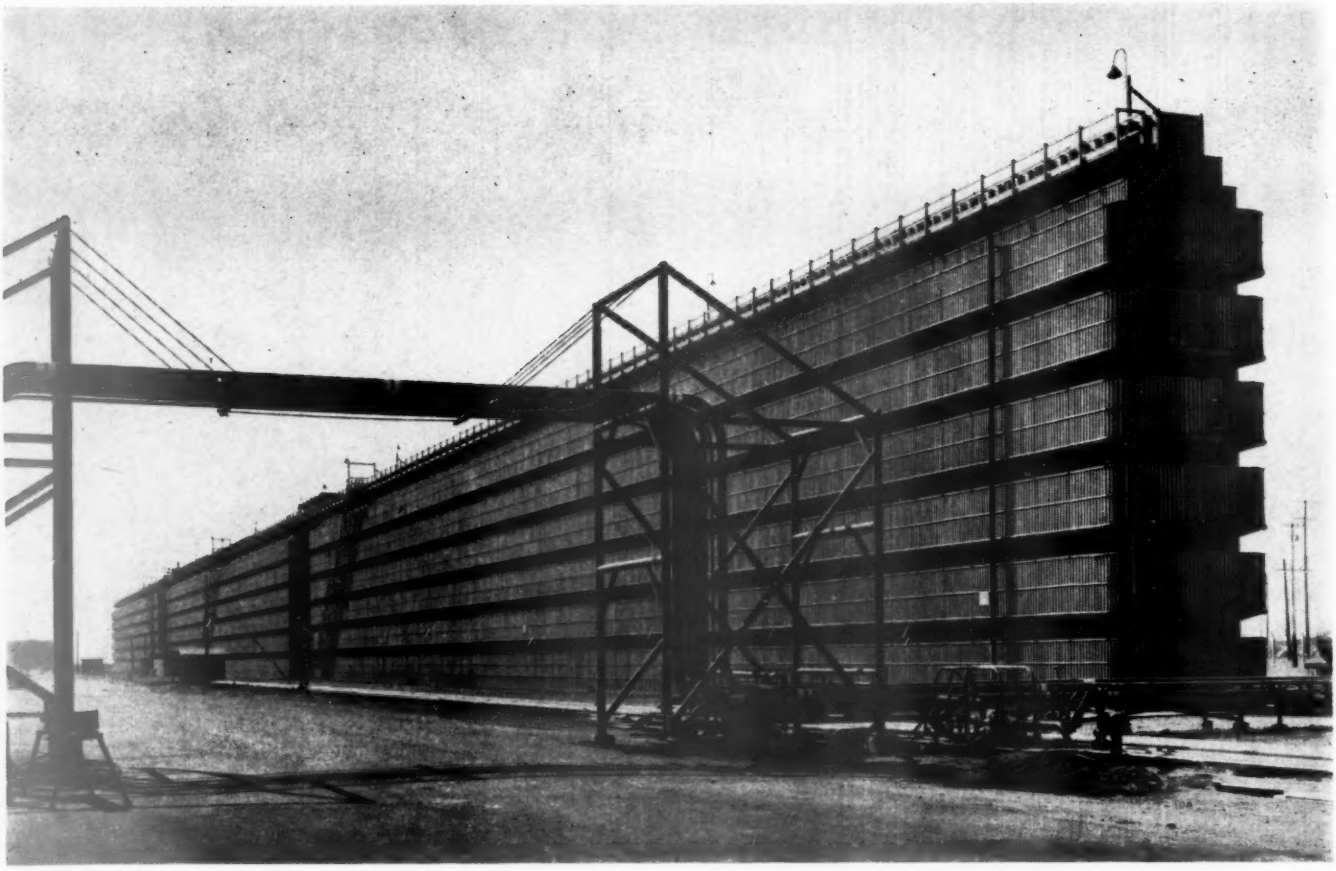


Giant cooling tower.

Maintenance of cooling towers

By JAMES G. DE FLON, *Chief Engineer,*
Manufacturing Division, The Fluor Corporation, Ltd.

Cooling tower maintenance is a subject that, in the past, has not received sufficient attention from plant operators. In most plants there is a program of preventive maintenance for all operating equipment, and such a program should certainly be extended to include cooling towers. There is little doubt that the inaccessible location of most towers, either on a roof or on the outskirts of the plant, is responsible for this; however, it should be remembered that an adequate supply of cold water is most essential for satisfactory and efficient plant operation.

The very principles upon which the cooling tower functions also gives rise to the problems of its maintenance. For instance, in order to obtain the desired cooling of circulating water, it is necessary that evaporation take place, and this creates a new problem by increasing the salt content of the water.

In order to perform satisfactorily, cooling towers are usually installed in open, unobstructed areas where wind velocities are such as to allow dust, dirt, and debris to be carried along. Since the air passes through the tower over which water is falling, the debris would be washed out of the air and into the basin, and another problem is created.

In order to keep the salt content of the water in the basin to an absolute minimum, and also to remove any collected dirt, dust, and other debris from the basin, it is recommended that a continuous blow-down be made a part of the cooling tower system, and that the tower be scheduled for periodic shut-downs so that the internal filling of the tower and the basin can both be cleaned.

● **Water treatment.** In discussing the maintenance of a cooling tower, it is well to remember that the maintenance of the tower, exclusive of any mechanical equipment, is closely associated with the quality of the water used. It is therefore almost impossible to discuss cooling tower maintenance without discussing cooling water treatment. The problem of water treatment is an entire field in itself. The following is the general opinion of a number of plant operators and is not intended to be a solution to a specific water treatment problem, but is to be used only as a guide in this matter. For specific problems, it is recommended that any one of a number of companies specializing in water treatment be contacted. Briefly, however, water treatment is done to control algae, to control scale formation, and to prevent deterioration of the materials used in the construction of the equipment.

Many operators have found chlorine to be one of the most suitable agents for the control of algae. In many plants satisfactory algae control is obtained by injecting 6 to 8 lb of chlorine per day for each 1000 gpm circulated. If this amount is consistently added to the water, however, a type of algae immune to chlorine will soon develop. Therefore, every ten days or so for a short period of time the amount of chlorine

supplied to the system should be increased several times, thus preventing this chlorine immune algae from developing.

Generally speaking, by controlling the pH of the cooling tower water, it is possible to control the rate of scale deposition in piping and on exchanger tubes. The higher the pH of the water, the greater the tendency for a scale to deposit. When the pH is below seven, little or no scale deposition occurs; rather, the metals in contact with the water slowly begin to dissolve. The latest, most satisfactory practice is to keep the pH of the water between 6.5 and 7, and then to add a corrosion inhibitor to the system. This keeps the piping and exchanger tubes clean, and prevents the metal from corroding. The above treatment should only be attempted under the advice of a water treating specialist, however.

In certain areas of the western United States, the water tends to be very alkaline due to the presence of sodium, calcium, and magnesium salts occurring in the form of bicarbonates. This situation is further aggravated as the cooling tower tends to concentrate the salts in the system. It has been found that when the pH of the water is more than 9.0, and when large amounts of bicarbonates are present, the structure of the wood in the cooling tower may be affected seriously. It is particularly noticeable where the wood is alternatively wet and dry, a condition that occurs on the sides of an atmospheric tower. At these points the bicarbonates concentrate and turn into normal carbonates. The carbonates attack and dissolve the lignin in the wood, producing an effect that is termed delignification. This is evidenced by a soft spongy, stringy wood structure that appears to be decayed. The only way delignification can be absolutely prevented is to remove the bicarbonates from the circulatory system. This is impractical in many cases; however, plant operators report delignification can be controlled by keeping the pH of the water below 8.5.

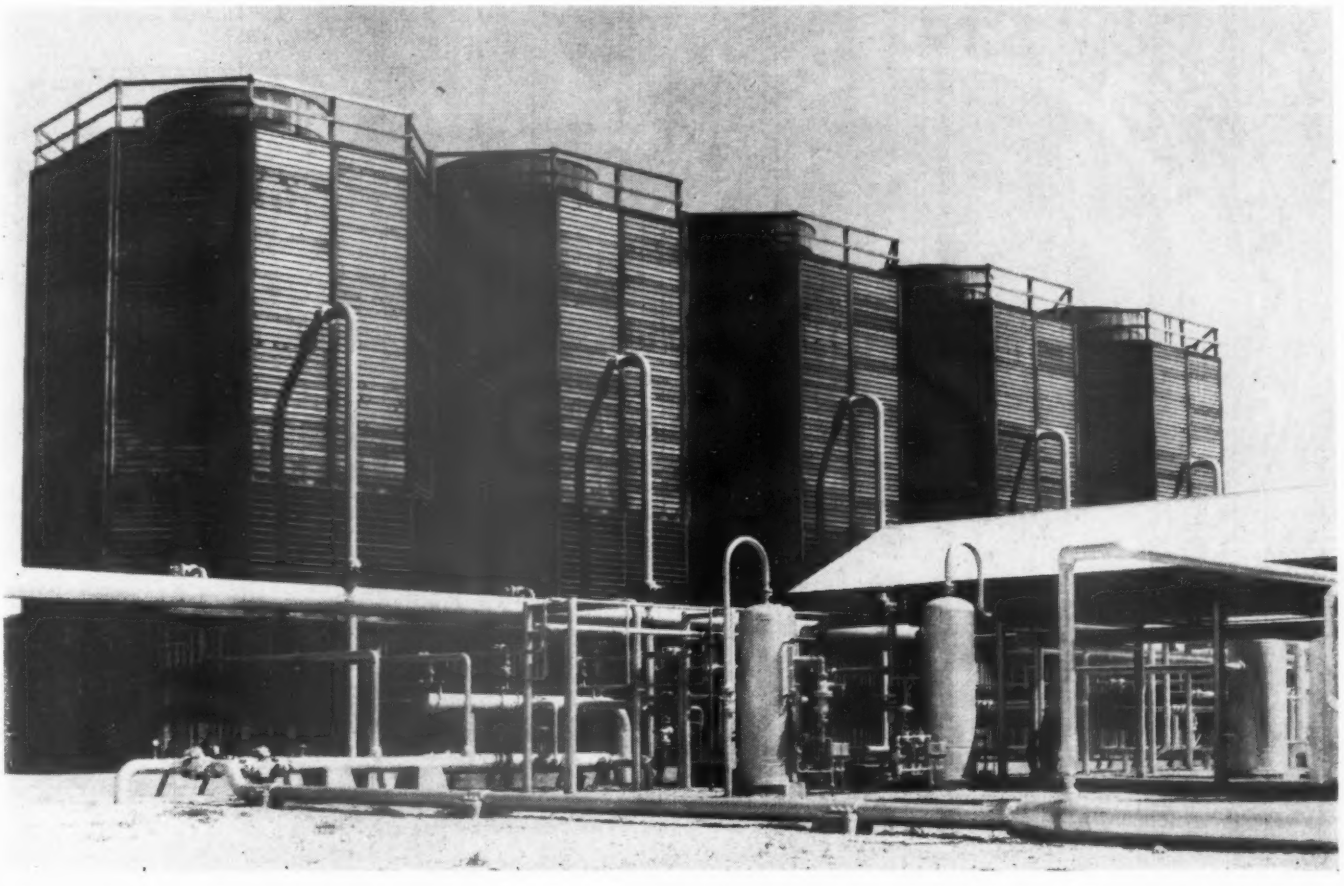
Once the importance of the water problem is understood, the operator should next consider the scheduling of a regular inspection and maintenance program for his cooling equipment. This regular inspection program should include the distributing system, filling, outside covering (paneling, louvers or aerators and drip panels), framework, basin, drift eliminators, coilshed sections, and mechanical equipment.

● **Distributing system.** The importance of maintaining the distributing system at peak efficiency cannot be overemphasized. The function of the distributing system, as the term indicates, is to distribute the water uniformly over the top of the tower, and to break it up into fine particles in order to expose as much water surface as possible to the air. There are four general types of distributing systems in common use today, namely, the upspray, the downspray, the flume systems and pantype systems. Before discussing the specific types of systems, however, it is well to point out that, regardless of the type of system employed on new towers, it will be necessary to inspect the nozzles every week or two for the first three months of operation. That is, to make sure that any wood splinters, shavings, or other debris normally found in a new tower have not plugged some of the nozzles.

The upspray system consists of a central header with pipe sidearms to which, at regular intervals, are attached the upspray nozzles. This system ordinarily operates at 5 to 6 psi nozzle pressure, and depends on centrifugal force rather than small orifices for fine breakup of the water. The nozzle orifices are usually about 1 in. in diam. This large opening, together with the 5 or 6 psi pressure drop is sufficient to prevent algae, small rocks, and sand from plugging the nozzles. The system is usually situated about 6 or 8 ft below the drift eliminators on mechanical draft towers, and about the same distance from the top of an atmospheric tower. The nozzles spray up and completely fill the spray chamber with finely divided water. This type of system will distribute the water uniformly with a wide variation of water flow. This system requires a minimum of attention, but should be inspected every nine to twelve months and any obstructions in the nozzle should be removed. This inspection, of course, is predicated upon the fact that the customer inspects the system as mentioned above during the first two or three months of operation.

The downspray system consists of a central header with pipe sidearms to which, at regular intervals, are attached downspray nozzles. This system is usually as close to the top of the tower as

A 5-cell cooling tower.



possible and operates on about 1½ psi nozzle pressure. Because of the low pressure, the nozzle must operate on the principle that water impinging on a plate will be distributed evenly. This system will perhaps not keep itself quite so clean as the upspray system, however, it too will uniformly distribute water with a wide variation of water flow. This system should also be inspected every three to six months.

The flume type system is composed of a main flume extending around the outside of the cell with interconnecting side flumes. This flume is usually constructed of wood. In the bottom of the flume, holes are usually bored into which are inserted plastic discharge tubes. Two to three feet directly below each discharge tube is a plastic splash plate upon which the discharge stream from the flume impinges. The effect of the stream of water falling on this plate causes a splashing action that distributes the water. This type of system is not as flexible as the two types previously described. At high water rates the flumes overflow and at reduced water rates the water is not uniformly distributed. This type of system presents a continual maintenance problem. Because the flumes tend to open up at the seams, they require leveling, and the splash plates have to be renewed periodically as well as adjusted so that the stream of water impinges directly on the center of the disk. The flumes form an ideal place for sludge, algae, and sand to accumulate and therefore they require frequent cleansing. Also, since the algae growth varies with the water temperature the open flumes offer an ideal place for its growth. This type system should be inspected every 30 days and repairs made immediately. If allowed to get into a state of disrepair, the performance of the tower will be seriously affected, and the cost of making the repairs will be increased.

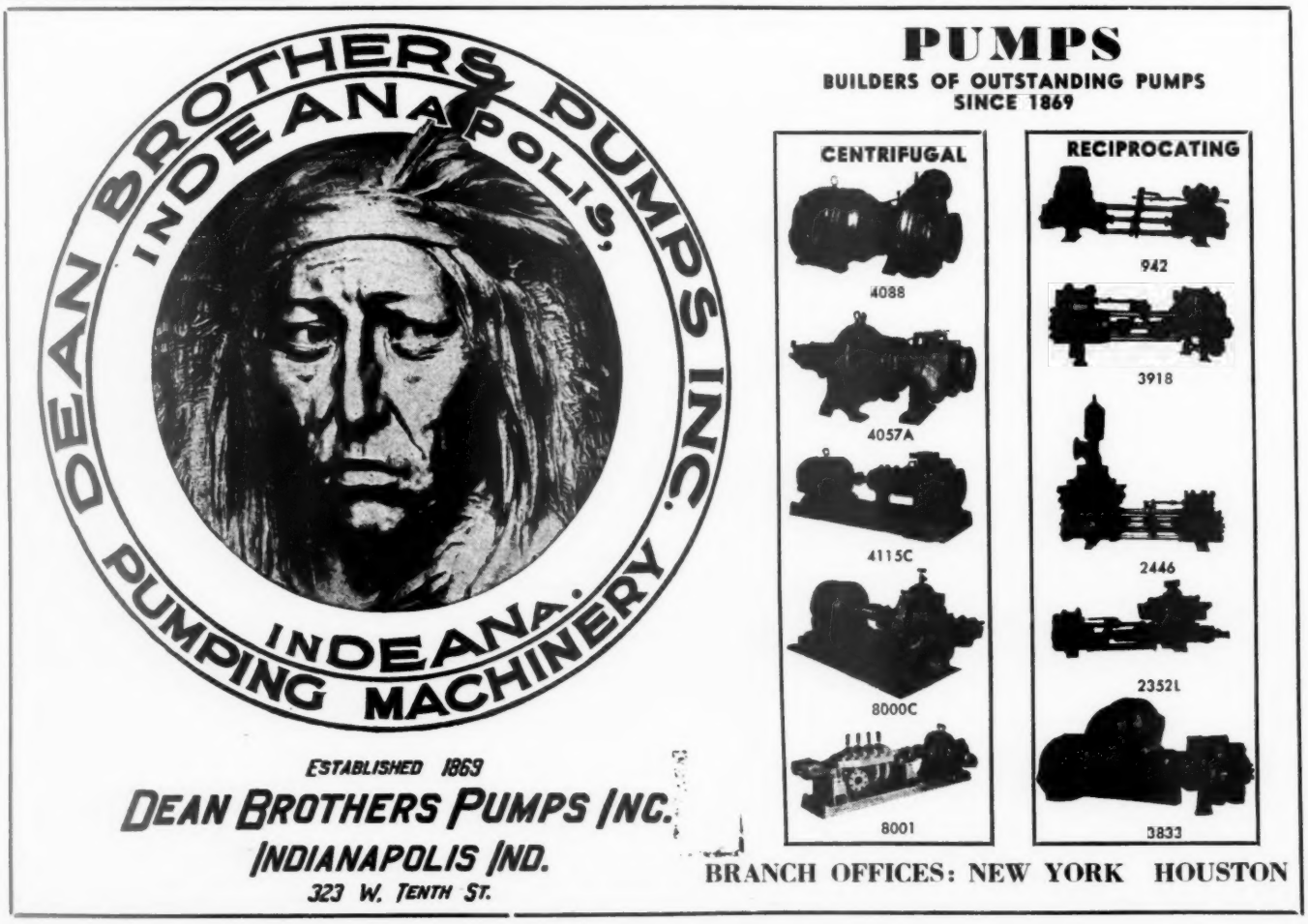
Another type of flume system is the open pan type, which covers the effective part of the cooling tower. In this type a large number of small nozzles, operating at an extremely low water head, are used. These easily become plugged with small pieces of debris. This type of system is susceptible to increased algae growth, due to the hot water temperature, and to its exposure to direct sunlight. By placing a cover over the distributing system, much of the debris blown in by the wind can be eliminated. This will also retard algae growth, for it shields the water from direct contact with sunlight. If covers are provided for the system, inspection should be made every two to three months; if not, inspection should be made more often.

● **Filling.** The function of the filling is to increase the contact between air and water, primarily by offering new exposed surface to the air as the water cascades through the tower. Another function is to maintain proper distribution of both air and water. Its efficiency is affected by oil, dirt, algae, and other foreign materials, and it is, therefore, important that the filling be kept clean. A filling composed of flat horizontal slats is more subject to the collection of foreign matter than are the decks composed of vertical or sloping slats. Sagging filling tends to concentrate the water in the areas of the low spots of the fill. This in turn causes air channelling, for the air will not pass through areas of high water concentration so readily as through areas of low water concentration. This air channelling reduces the contact between air and water, thereby reducing the performance.

There are a number of different types of filling used. In general, they fall into two classes; the grid type and the slotted lath type. The grid type consists of boards or battons nailed upon cleats to form panels. These panels or grids are usually substantial enough to function as scaffolding during the period of erection, and are convenient to walk upon when cleaning and inspecting the tower. The grids are easily removed and are substantial enough to be cleaned with a fire hose.

The slotted lath type of fill consists of slotted lath, through which are threaded other lath. This type of filling is not nailed and should not be walked upon. It also cannot be readily removed nor should it be cleaned with a fire hose.

The presence of oil in the cooling tower water is detrimental to tower performance. This is because the oil-soaked filling will not be wetted by the water. This results in improper breakup of the water and a reduction in the wetted surface exposed to the airstream. Oil deposits have been removed from the filling by means



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of solvents and steam; however, it is usually cheaper to replace the filling.

Algae growth probably contributes more to reduce the performance of cooling towers than any other factor. Once algae has made headway there is very little to do but to shut down the tower and do a thorough cleaning job. This is usually accomplished by means of a fire hose and/or circulating a strong chemical solution. This should be immediately followed by a flushing and draining of the entire cooling system to prevent fouling of the heat exchanged surface by the dead algae.

● **Cooling tower basins.** Cooling tower basins are usually constructed of concrete, however, they are also made of redwood and steel. Occasionally one will find that the water circulated in the tower will have a detrimental effect on the concrete basin; in such cases, it has helped to plaster the basin with an asphaltic base material similar to roof putty.

When cooling tower basins are constructed of redwood, it is difficult to maintain a water tight basin. This is particularly true when a tower is used seasonally such as in connection with an air conditioning system. A redwood basin should never be allowed to dry out, as a change in moisture content of the wood is followed by a change in its dimensions. If redwood is allowed to dry and shrink, and then to soak and swell, it will be found that the wood will never quite revert to its former dimension. Therefore, if this wet and dry cycle is repeated very many times, it will be found that the basin will no longer be water-tight. This also applies to redwood stave pipe. Redwood stave pipe is often used as a primary distributing header and should not be allowed to dry out. Also, the reinforcing bands should be kept tight at all times to prevent leakage.

One of the best ways of stopping a redwood basin from dripping is to add shredded asbestos, similar to the fibrous insulating material used in plastering fractionating columns, to the area of the basin containing the leak. This shredded fibrous material will then migrate to the area of the leak and it will flow into and seal the crevice.

Suction pit screens should be incorporated in all cooling tower basins. They strain extraneous matter out of the cooling system, and do much to reduce the maintenance of the circulatory system.

An attempt should always be made to keep the water level in the basin above the level of the anchor bolts, and anchor castings. The interfacial surface between the air and water has been found to be very corrosive. Inspection shows accelerated corrosion to occur at the water line when very little, if any, occurs above and below this point.

● **Mechanical equipment.** Because failure of any part of the mechanical equipment (such as the fan, gears, or flexible coupling and floating shaft) will shut down the unit, it is important that a regular inspection and maintenance program be adopted. Here is a minimum service schedule for the various pieces of apparatus.

Gear. The oil level in the gear should be checked every 30 days. If it is found that the level has gone down, the gear case and oil seals should be checked for leaks, and appropriate steps taken to correct them. If, on the other hand, the oil level appears to have risen, drain a one quart sample from the bottom of the gear case and check for emulsification and contamination. Because the gear on an induced draft tower is situated in a hot humid, air stream, condensation of moisture may occur in the gear case. This is particularly true in towers that are operated intermittently. Should there be any signs of emulsification, the oil should be drained and refilled with the type of lubricant recommended by the manufacturer. Also, an inspection should be made of the oil seals, particularly the oil seal on the slow speed shaft. As oil seals are normally inserted in a small recess in the housing, it collects the moisture condensed on the fan shaft. Any failure of the seal, or corrosion on the shaft at this point, will permit the collected water to enter the unit.

An oil sample should be drained from the bottom of the gear case every three months. Again, if the oil shows any sign of emulsification, contamination, or deterioration, it should be drained and refilled. The oil should be drained and refilled every six months with the exact type of lubricant recommended by the manufacturer.

Once a year the oil seals on the gear should be examined and replaced if necessary. Also, the bearings should be checked for play, particularly the bearings on the fan shaft where the greatest wear usually occurs. This can easily be checked by rocking the fan blade up and down. If any appreciable wear has occurred, the bearings should be either adjusted or replaced. Where oil is found to be emulsified in the gear unit, indication of excessive wear will usually be found on the lower slow-speed shaft bearing. This is because on some reducer designs sufficient sump capacity for collecting water and sludge is not provided below the lower main bearing. If this condition exists, some relief can be obtained by substituting a large capped reducing nipple for the drain plug in the center of the gear case, thus allowing room below the bearing for the water to settle.

Couplings. The floating shaft couplings used on cooling towers fall into three classes; gear types, metal, fabric or rubber disk type, and the universal joint type.

The gear type coupling should be taken apart and inspected once a year. The lubricant, together with any contaminates, should be drained and discarded. The teeth on the coupling should be washed with kerosine and examined for wear before reassembling. Care should be taken in the choice of a lubricant for this gear type coupling since it operates in a hot, humid air stream and there is danger of moisture condensing inside.

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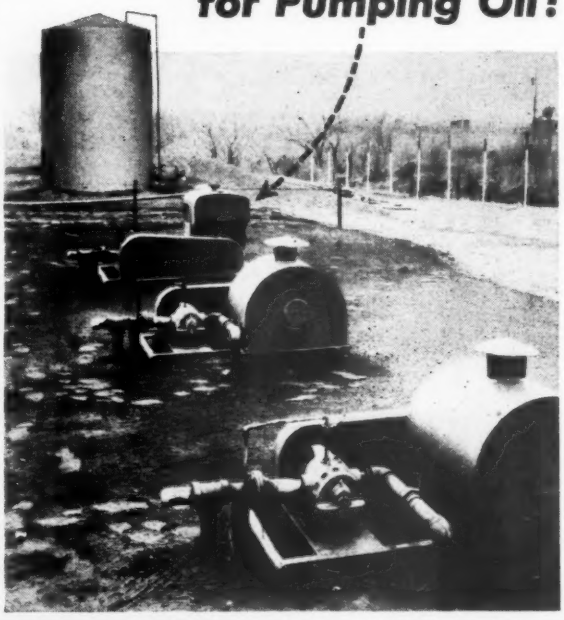

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As moisture condenses, the centrifugal action of the revolving coupling causes the water to displace the lubricant in the periphery of the housing. As the gear teeth are also situated on the housing periphery, serious wear may occur because of lack of lubrication. Because of this it is recommended that the lubricant used be of the water-proof type whose specific gravity is greater than that of water.

The disk type coupling should be examined every six months for cracks and breaks in the fabric or metal disks. Should they show any signs of wear, the disks should be immediately replaced. It is recommended for all couplings that heavy strap iron guards be made for each end of the floating shaft to confine the rotation of the shaft should the couplings fail. This is done to prevent the loose end of the shaft from whipping around and damaging the fan, as well as the motor and gear shafts.

The universal joint type coupling requires lubrication every three to four weeks. This type of coupling requires a heavy oil rather than a grease. Properly lubricated, this type of coupling will give by far the best service of any of the couplings previously mentioned, for its greater flexibility better adapts it for use on a wooden structure that is not rigid.

The gear and motor should be checked for proper alignment once a year. The following procedure for aligning floating shaft couplings is recommended:

The floating shaft and couplings should be removed, leaving a flanged hub on both the motor and gear shaft. Stretch a fine copper wire or chalk line over the top of both the motor and gear flange. Next, check with a square against the flange face and wire, first on one coupling and then the other. The square will show any misalignment. This should be done both with the wire or chalk line on top of the coupling and on the side of the coupling. Shifting of the motor and gear and shimming will make one edge of the square parallel with the wire in both positions. When this is accomplished, the unit will be in proper alignment.

Fans. The fan blades used on cooling towers fall into three classes: (1) Fabricated carbon or stainless steel, (2) cast aluminum, or (3) airplane wing section type.

Once a year the fan blade arms should be examined for fatigue cracks; this applies to all classes of fans. The fabricated stainless steel fan should require little or no maintenance while the carbon steel and aluminum fan blades may be scraped and coated each year or two with a preserving material. On the other hand, carbon steel and aluminum fans have been known to give five to ten years' service with no maintenance work on the blades whatsoever.

The airplane wing type fan blade consists of struts covered with fabric or metal. This type should be examined every three to six months for tears or rips in the covering. Should this occur, repairs should be made immediately lest the entire fan be destroyed.

A fan will become sufficiently unbalanced in normal service to require rebalancing every three to five years. This occurs because of the uneven erosion, corrosion, or deposition on the blades over a period of years. Very often vibration on top of a cooling tower will be blamed on the fan when in reality it is due to misalignment of the gear and motor. These two vibration sources can be readily distinguished. The vibration caused by an unbalanced fan will give a swaying motion to the tower because of its relatively great mass and slow speed, whereas the misalignment of the motors and gears will cause a high speed vibration that makes a rapping sound.

● **Conclusion.** In conclusion, we may summarize by saying that the following is a minimum maintenance schedule for an atmospheric tower.

Once per week inspect suction pit screens and clean as required.

Once per month inspect flume type distributing systems and clean as required.

Once every three months inspect and clean downspray distributing system.

Once every six months inspect and clean upspray distributing system.

Once per year shut down tower and thoroughly clean, particularly the distributing system, filling and basin. A thorough inspection of the structure together with the filling, louvers, and aerators should be made at this time. Any repairs required should be made immediately. Should the tower contain a flume type distributing system, it should be releveled and also repaired as required.

The minimum maintenance schedule for a mechanical draft tower is outlined as follows:

Once per week inspect suction pit screens and clean as required.

Once per month, (1) check oil in gear case for level and contamination; (2) lubricate universal joint type couplings, and (3) inspect and clean flume type distributing systems.

Once every three months, (1) check downspray distributing system and clean if necessary, and (2) inspect disk type couplings for fractures in disks.

Once every six months, (1) drain and refill gear case with recommended oil; (2) lubricate motor bearings, and (3) check upspray distributing system.

Once per year the tower should be shut down and thoroughly cleaned from top to bottom, including the basin. A thorough inspection of the structure should be made, together with the necessary repairs and replacements. Should the tower contain a flume type distributing system, it should be releveled and repaired at this time. The mechanical equipment should be checked for alignment and the bolts anchoring this equipment to the tower should be tightened. The fans should be inspected and repaired as required. The gear type couplings should be opened up for inspection and serviced and the gear box bearings and seals examined for wear. ★★★

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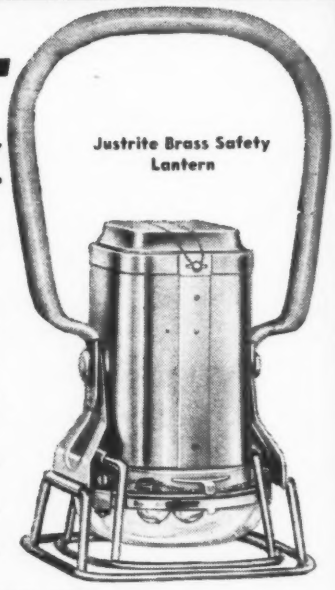

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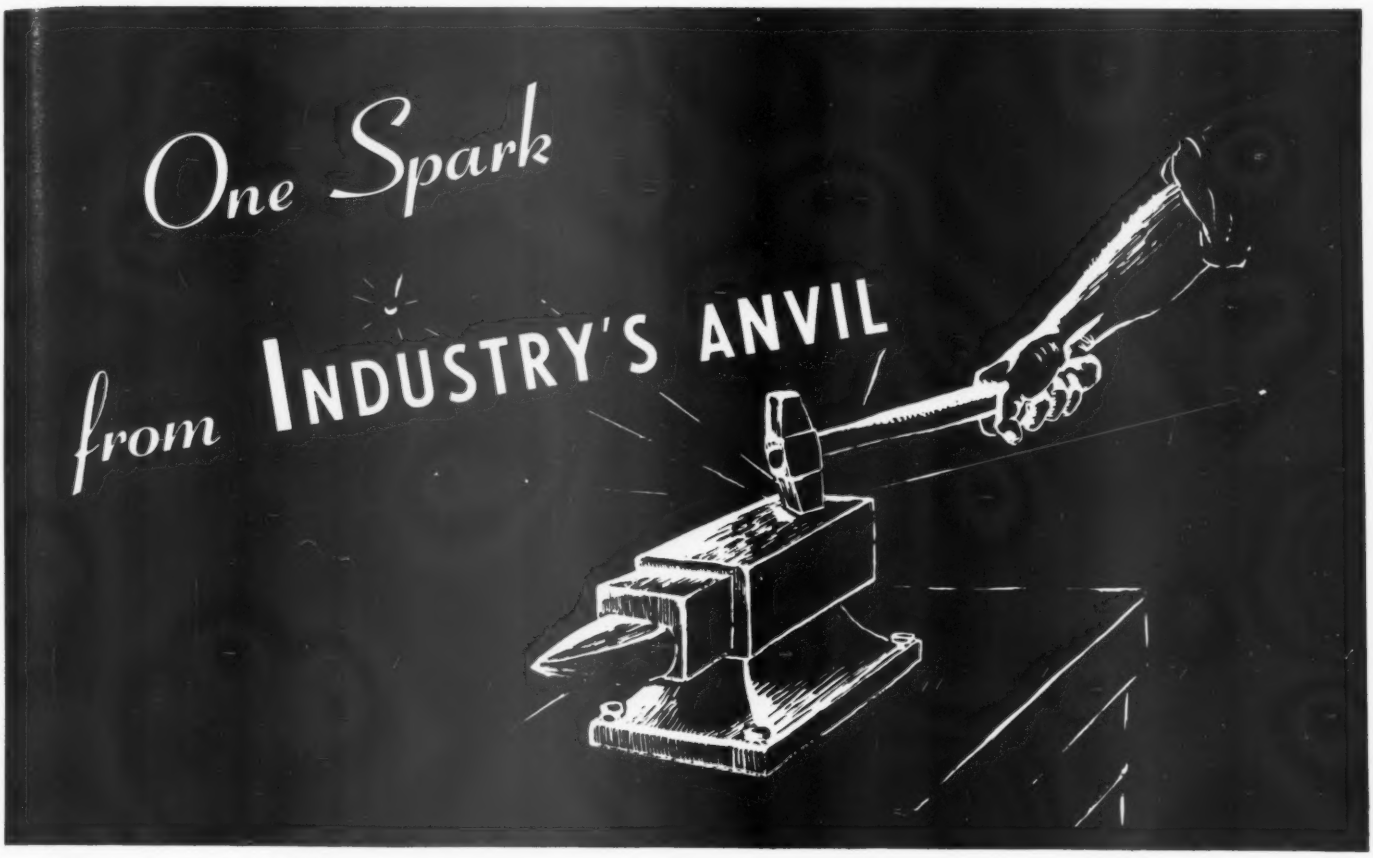

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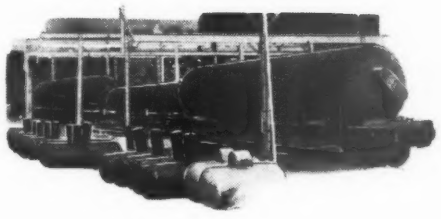

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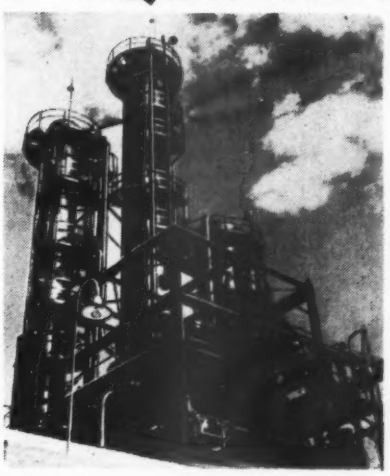

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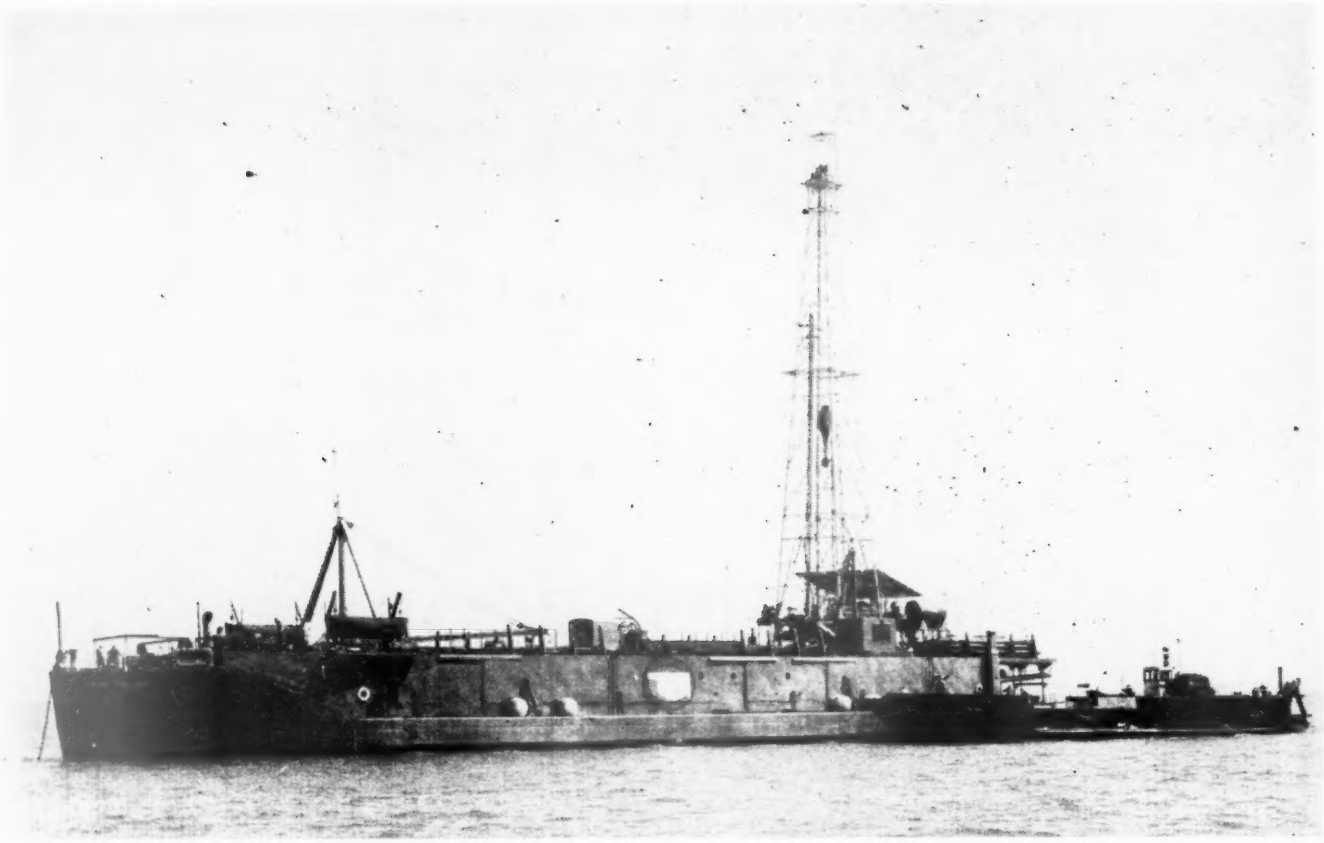


Dean Terrill moored to drilling barge *Frank Phillips*. Motorola antenna structure is mounted on drilling derrick.

Gulf tidelands wildcat and radio

By V. L. JANEWAY, *Communications Superintendent*
Kerr-McGee Oil Industries, Inc.

A 3000-bbl oil barge stood several miles off the Louisiana Gulf Coast, on one of the "wildest" wildcat oil ventures of all time, sparked by the Kerr-McGee Oil Industries, Inc.

EXCLUSIVE

On this day, instead of oil, the barge got trouble. A flash storm of high winds and rain ripped into the Gulf, tearing the barge from its moorings. The clumsy, elephantine barge rolled helplessly toward the West Indies with Toolpusher Baxter calling for help over the newly installed FM 2-way radiotelephone.

Captain Eddie Herbert of the converted LCT (Landing Craft Tank) *Dean Terrill*, hearing the call, headed his "ship" toward the foundering craft. Near daybreak, after an almost fruitless search and racking hours of labor against the rough waters of the Gulf, the *Terrill* nosed into dock with the barge in tow.

Later, the Kerr-McGee paper, *Kermac News*, reported, "We watched the whole dramatic rescue from the safety of our on-shore office—'watched' it by listening to the radio carrying both sides of the conversation taking place in the turbulent waters of the Gulf."

This radio drama, more real and thrilling than a soap opera, was only a small segment of the approximate 200,000 words of necessary routine conversation that took place for each foot of the unusual well drilling operation.

This venture into the Gulf Coast region of Louisiana, early in '47, gave Kerr-McGee—heretofore a prairie contract drilling firm—their first taste of over-water drilling. To drill an oil well on land is one thing; to do it on an offshore location is something else.

Holdings in the Gulf of Mexico to be explored were between 7 and 12 miles from land. As these locations were in open and unprotected waters, much thought had to be given to the elements that play havoc with those who venture to sea uncautiously. Such a water-borne operation called for marine equipment on which drillers could rely for supplies and support. Although the drilling sites for these wells were not far from land, salt marshes and swamps precluded putting a land supply point on shore near the proposed well locations.

The first material step taken was the purchase of three 85-ft war surplus air-sea rescue boats, a war surplus LCT and a former navy cargo barge—the nucleus of the operation. The cargo barge was converted into a drilling barge that became the backbone of the organization. It now houses everything required to drill a well except the huge engines that supply power to the drilling machinery. Mud pits were built into the double bottoms, mud pumps and their power units were installed on the housed main deck. Storage space was provided for drilling

LEE C.
DRILLING
MASTS

mud materials, drilling water, diesel fuel oil, and boatswain's supplies. Electric generating plants were installed having a capacity of 150 kw to supply power to the huge stiff-legged derricks atop the superstructure, and for lighting, heating, electric pumps, and galley ranges. Living quarters to accommodate 36 men, and a galley to feed them four hot substantial meals a day were installed.

A drilling platform was first anchored to the ocean bottom by driving steel pilings into the Gulf floor. These pilings were 24 in. in diam. and 140 ft in length. Driven to an ocean bottom penetration of 104 ft, and amply braced, 19 of them made a foundation that was practically part of the earth itself. On this was set a derrick designed to withstand wind forces of 125 mph. As the water was 18 ft in depth, the substructures raised the derrick floor 30 ft above mean water level. On the derrick floor heavy duty diesel engines and one mud pump were installed for emergencies. The drilling barge was to supply all other power and materials by means of jointed, flexible piping and conduit that could be disconnected in a matter of minutes. The fact that this lone drilling platform and derrick rode out the severe hurricane of September 20-21, 1947, attests to the adequacy of the structure for this type operation.

One of the first indicated needs was for reliable communications to maintain a constant link with the land supply point and the boats supplying this well-drilling unit. The comumnications division was set into operation to survey the requirements, then provide the equipment to do that job.

Southern Louisiana being in the region of semi-tropical line squalls, seasonal hurricanes, and under the constant influence of atmospheric conditions that, in varying degrees, paralyze amplitude-modulated systems, frequency-modulated radiotelephone was a requisite.

A communications system was needed that would operate unfailingly over a minimum distance of 43 airline miles between suppy headquarters at Berwick, Louisiana, and ships in the Gulf. It was decided that, with suitable antenna installations, the 30-40-mc industrial applications band would provide the desired coverage.

After licensing and procurement details had been taken care of, Kerr-McGee set its Motorola FM network into operation on August 28, 1947, on a frequency of 30.82 mcs, under calls of KXXA for the land-based headquarters station, and KXXH for the mobile units. The headquarters station was the first completed, followed by KXXH-4, the 85-ft crew boat, *T. M. Kerr*.

The actual construction of the drilling platform in the Gulf was begun before the radio network could be set up. The handicaps under which this operation was conducted, due to lack of communications, can now be fully appreciated. It provides a comparison between "without" and "with."

Tom Seale, who directed the construction of the platform from the rolling deck of the *T. M. Kerr*, returned to Berwick after several days of isolated work. He brought in a choice selection of statements on the difficulties of working at sea without communications to transmit the answers to the thousand and one questions that cropped up during the unfamiliar work.

Before the *T. M. Kerr* put to sea again, she had aboard a radio installation, consisting of a 50-watt Motorola transmitter and a new-type, low-drain FM receiver for battery conservation.

After the radio installation on the *T. M. Kerr* was completed tests were made every 10 minutes during its next trip to the drilling site. Transmission and reception was loud and clear. The 50-odd mile transit was made in approximately four-and-one-half hours and it was a great relief when Tom Seale announced the boat's arrival at the work site.

Needless to say, the FM net speeded progress an inestimable amount. When radios were not available, a boat had to be dispatched as a substitute medium. To continue such costs would have precluded a profitable venture.

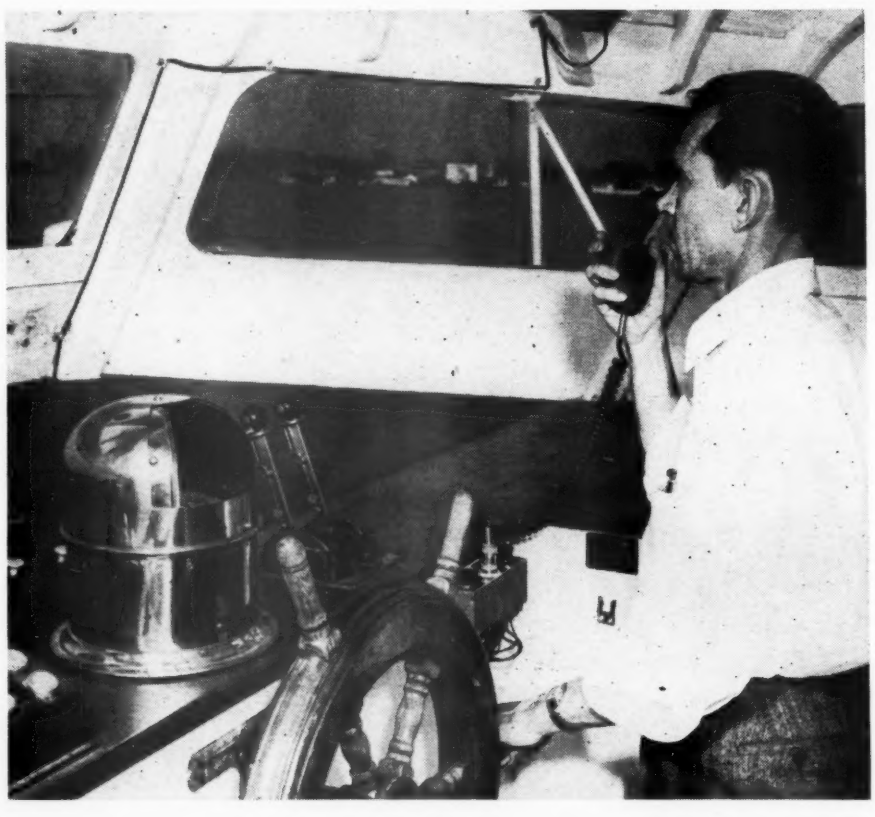
While work progressed in the Gulf, the rest of the marine installations were completed in time to accompany each boat as it was put on its trial runs.

The LCT, the *Dean Terrill*, had long since gone into operation, hauling the heavy oil field machinery, substructures, and derrick steel to the location. Consequently, her FM radio equipment was the third installed. Her movements were directed by radio to time her arrival in the Gulf simultaneous with the need for the items she carried. Not a wasted gallon of fuel nor an hour's time was lost for lack of communications.

As the boats were completed and run into the Gulf on maiden voyages, constant radio tests were conducted to determine the quality of each installation. Undoubtedly, at times, it sounded like the meeting of a ladies' sewing circle. As Tom Seale, at the drilling site, stated: ". . . With all the boats talking back and forth as they are, it sounds like a glorified party line. This is a far cry from the early days out here . . ."

Radio communication is essential to Kerr-McGee, not only to increase operational efficiency, but to protect life and property. To make a trip from headquarters to the location means boarding a boat at the company's dock in Berwick, traveling the downstream leg of the Atchafalaya River for a distance of 15 miles, across 10 miles of the Atchafalaya Bay, out past Eugene Island Lighthouse in the approach channel, which constitutes approximately 9 miles, then facing 20 miles of open and unprotected waters of the Gulf of Mexico. This area presents water navigation with its one serious natural handicap — weather! Here fog abounds for days.

J. L. Hickman at the wheel of the crash boat *T. W. Fentem*. This photograph indicates the proximity of the radio control head to the boat operator. From the position of the throttles, it appears that "J. L." is really heading up the Atchafalaya River at high speed. The *T. W. Fentem* is capable of speeds up to an estimated 35 knots per hour. She has never been opened fully up.



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Heavy, seemingly impenetrable fog that necessitates, at times, anchoring a vessel due to lack of visibility.

The radio log at headquarters carries this entry under date of February 12, 1948: "KXXH-4 calling KXXH-3—what is your position now? I am standing by at the rendezvous awaiting your arrival."

"KXXH-3 to KXXH-4—we are approximately 10 miles from you, and proceeding at a dead-slow rate due to heavy fog. When we entered it, the boat seemed to slow down, it's so thick."

Of course, this exaggeration confirms the fog's real hazard.

When the hurricane struck this area in September, 1947, its proximity was known far enough in advance to radio the drilling site to suspend all activity on the water and get all floating equipment into sheltered waters. One of the first things the communication division did when work began was institute a weather obtaining procedure, making it possible to chart and track all weather fronts and analyze their possible effect on our work.

A list of the commercial and marine radio telegraph stations broadcasting weather information was compiled and a watch established on these frequencies. Twice a day, in good weather, this information is received and delivered to the drilling barge and boats in the Gulf. When bad weather is imminent, or line squalls and hurricane weather are to be reckoned with, a 24 hour watch is maintained on weather broadcasting stations and, as a weather front is located, it is charted and plotted on a map at headquarters, thus marking its path and progress. As yet a storm has not caught Kerr-McGee in the Gulf without adequate warning. It has been necessary, on occasion, to abandon activities and seek shelter. Due to the seaworthy bulk of the drilling barge, *Frank Phillips*, from which the drilling operations are conducted, retreats to shelter have been few. The *Frank Phillips*, having a length of 260 ft, a beam of 48 ft, and a moulded depth of 15 ft, can ride out anything but the most severe storm. Her four heavy anchors and the stern chain, passed around the pine cluster-piles of the drilling platform, secure her in a manner that makes for considerable tenacity.

To insure a dependable link with the drilling site, duplicate radio installations are used, one on the *Frank Phillips* (KXXH-2) and the other on the drilling rig (KXXH-1). Several times during heavy blows, the *Frank Phillips* has been blown several hundred feet from the platform after losing her grip on the cluster-piling and dragging anchor until she streamed herself into the wind and sea. Since, after suspending drilling, it is necessary to circulate the drilling mud to keep the hole from "bridging" a crew must be kept on the rig. When severed from the barge, the FM radio on the rig keeps the crew in contact with administrative personnel on both the barge and at headquarters.

Shutdown time on a drilling rig costs an appreciable sum of money. It is lost time from which nothing can be salvaged. Such showdowns are usually occasioned by a broken part that needs replacement. It is impossible to maintain a sufficient stock of spare parts at the rig to make all replacements. The alternative is to obtain them from a supply house as quickly as possible. Here again is demonstrated the vitally essential need for good communication methods.

In the office aboard the *Frank Phillips*, Toolpusher Charlie Howard talks with Bill Glenn at the headquarters office in Berwick, Louisiana, via two-way radiotelephone. Due to limited space the control head and speaker were mounted on a book rack at the single desk. The microphone and speaker are within reach of the toolpusher as he sits at his desk and directs drilling operations.

Many anxious moments were experienced by the Kerr-McGee staff at headquarters during the progress of drilling well No. 1. The feeling toward this "wildcat" was optimistic from the outset. It was to be a shallow well because geophysical surveys indicated the possibility of "oil seed" between 1200 and 2500 ft. When the bit was twisting in the formation at this range, ulcers were in the making.

A few slight oil showings were had as drilling progressed below 1200 ft, but nothing of importance developed. It was decided to go on down to the salt dome regardless of the earlier findings. At approximately 1600 ft it appeared that the "seed" were sufficiently evident, but drilling continued with increased caution. After drilling into the salt dome, which marks the end of the line, the tools were reset at the good-showing depth and preparations made to test the formation to determine its oil producing capabilities.

During the testing process, Tom Seale was " . . . pacing the floor like an expectant father . . . ," hearing and seeing nothing,—nothing, that is, except the litte, grey box housing KXXA. He was keenly aware of any sound it made. After seemingly hours of delay in reporting its findings, the *Frank Phillips*' radio signals split through the fog: "KXXH-2 calling KXXA."

Tom Seale swept the microphone from the hook and advised the party at the other end to "let 'er rip."

"KXXH-2 back to KXXA — the test shows two good oil-bearing sands that can be produced commercially. This wildcat is now a producer." "KXXA to KXXH-2—we'll get in touch with the home office in Oklahoma City with this information and will call you back as to how to proceed. KXXA clear!" Here was accomplishment.

As to the part radiotelephone played, the key lies in the previously mentioned estimate of 200,000 words of essential radio conversation taking place with each foot of hole drilled on the well. This may seem to be a lot of "chatter," but it is not to be assumed that Kerr-McGee's net was cluttered with frivolous and unnecesary transmissions. This

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type of industrial venture necessarily bases its very existence on detail, detail, and more detail. Every future action must be anticipated. This calls for long-distance planning, otherwise operating costs will eat up the budget.

The radio antenna at KXXA is in a relatively noisy location. There was not much choice in its location due to the nature of the terrain in this region, but the station has been able to cope with this man-made static very effectively so far. The customary ½-wave coaxial antenna is mounted atop a pine pole whose height is 105 ft above the ground. This places the tip of the antenna approximately 121 ft in the air. The radiator is fed with ⅞-in. gas-filled copper coaxial tubing. As is the case in all Kerr-McGee stations in this division, the KXXA transmitter has 50 watts output. This power has proved to be ample in this location.

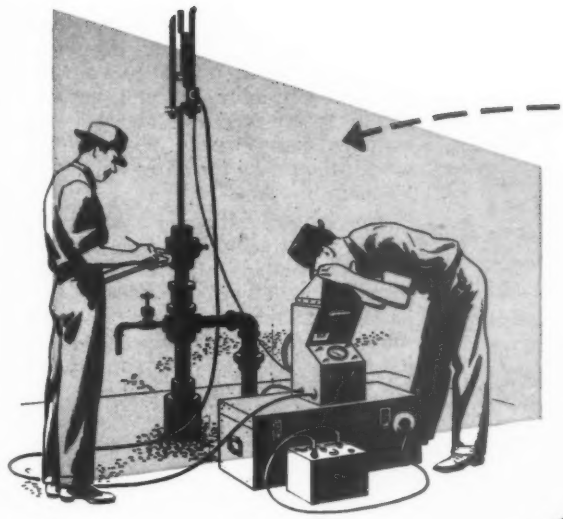
FM equipment is extremely versatile. Specifically, reference is made to the boats that were purchased and their electric supply systems. The 85-ft crew boats and the *Dean Terrill* had 120-volt d-c plants. As this is hardly a voltage from which radio equipment of this type can be operated direct, voltage conversion was necessary to power the transmitters and receivers. Various methods were tried. The first one was coupling a ¾-hp 120-volt d-c motor to a heavy-duty auto generator, thus making a battery charging motor-generator set and then operating the radio from a 6-volt battery. This worked. but was not satisfactory due to the unnecessary heavy drain on the ship's line. Further, because several pieces of such equipment had to be fabricated, the cost seemed to be considerably higher than for some other method.

A suitable voltage-dropping resistance net would work, in theory, to charge the radio battery, but in actual practice it was of no value, for the standby ships' batteries, which always floated across the light plants, intermittently developed leaks to ground by way of spilled battery electrolyte.

Another means was to run leads to the bank of ships batteries and take voltage from just one of those batteries, but that was not good practice, because that particular battery would be the weakest one in the set and the entire ship's voltage would depend on the condition of it.

It was ultimately remembered that the boats had army radio equipment in them when acquired. Two types of transmitters were in the radio room that required 115-volt, 60-cycle a.c. for operation. They took that voltage from rotary converters operated from 120-volts d.c. As the converter's output was 15-volts a.c., at a rating of 500 watts, it seemed logical that here was the power source

Headquarters station with Chief Clerk Bill Glenn at the hand set of the remote control unit. Glenn is on duty 24 hours each day and has a remote control unit on a night table at his bedside to give him full control of the KXXA-KXXH radio net day and night. He hasn't had a good night's sleep in months, he says.



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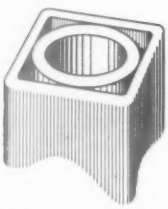

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20th compact member

The Interstate Oil Compact Commission in Oklahoma City announced last month that Mississippi had become the twentieth member with passage of a senate concurrent resolution authorizing the governor to execute the compact agreement.

Membership of the 13-year-old compact commission now includes states in which is produced more than 80 per cent of the nation's oil and 90 per cent of the natural gas, the announcement said.

The compact is a voluntary association of oil and gas producing states with the purpose of conserving petroleum resources.

Mississippi also has its first oil and gas conservation statute.

needed for operating the radio equipment. The Motorola factory swapped power supplies and the conversion was carried out to a-c equipment. This system has been very satisfactory. Battery operation, and inherent trouble and constant attention consistent with battery power, had been bypassed—much to the satisfaction of those whose job it would have been to maintain it. In the process of settling on the desired operating voltage source, power supplies in the FM sets were interchanged several times.

The latest acquisition in the marine department is a 63-ft crash boat that has a 24-volt d-c system. This presented no problem in radio power because all angles had been covered by this time. A 24-volt d-c motor was acquired and coupled to a 6-volt auto generator for battery charging. In this case battery operation was necessary. A 6-volt mobile power supply was installed in the transmitter and receiver to operate in this boat and it was placed in commission in good time.

The drilling rig was also equipped with 120-volts d.c., but here was found the greatest handicap for power requirements. The rig generator took its power from the main drive of the rig. Those engines are varied in speed with the requirements for horsepower and revolutions necessary to accomplish any certain operation in the process of drilling. Consequently, the generator would also be varied in speed, producing an inconstant voltage. To partly alleviate such surges and dips in voltage, the manufacturers supply a separate field exciter, driven from the same source as the generator. This exciter acts as an automatic voltage regulator by increasing the generator field as the generator decelerates, and decreasing the field strength as the rpm's accelerate. The theory was correct, but inertia has a constant field-day in this hook-up. Sudden acceleration and deceleration makes the generator output vary between 95 and 130 volts. Obviously, a rotary converter hooked to this voltage would not only vary in a-c voltage output, but the a-c frequency would constantly be changing, and, at times, possibly drop to 40 cycles per second or lower. Efficiency and power factor in transmitter and receiver power supplies could hardly be predicted—even if the rotary converter did continue to operate.

The battery charging motor-generator set that was originally on the *T. M. Kerr* was pulled out of moth-balls and installed, together with its associated battery, and the one transmitter-receiver set-up that had been retained intact with its mobile 6-volt power supply. Thus KXXH-1 found its voice and ears.

The light 85-ft craft have carried a considerable share of the load in this activity. All three were christened and named in honor of top-ranking executives of Kerr-McGee Oil Industries. The *T. M. Kerr*, namesake of the head of the drilling division; and the *T. W. Fentem*, after the secretary-treasurer of the company, were early stripped of their original engines and supplied with 225-hp diesel plants. This cut their speed by one-third but made them more efficient and reliable. The third boat, the *Rob't S. Kerr*, was retained in commission as she was with 2500-hp to drive her through the water at 30-plus knots per hour. Named in honor of Robert S. Kerr, former governor of Oklahoma, and president of Kerr-McGee, this boat was the flagship of the fleet, held in readiness to run busy executives to the scene of drilling, or standby in any emergency. As such, she has served, and served well, to rush an injured man to the hospital, or speed a critically needed part to the rig. In addition to FM radiotelephone, she is equipped with a marine radiophone transmitter and receiver that gives her a link, through the telephone companies, to any long-distance telephone switchboard in the world.

Likewise, the barge *Frank Phillips* has a marine radiophone installation that the drilling superintendent and tool pushers can place in service on a moment's notice to order special parts from an oil field supply house direct, or make reports direct to the company's home office in Oklahoma City without necessarily tying up the FM net for appreciably long periods of time.

At this writing, Kerr-McGee is far advanced into the operation of the second well. Another drilling barge, the *K. S. Adams*, is being fabricated to take care of the increasing momentum of activity. Another LCT, the *Kermac No. 1*, is completed and ready for service to assist the *Dean Terrill* in moving the stream of supplies and machinery into the Gulf that is required for setting up new locations. These two new craft will be tied into the FM net within a very short time.

Kerr-McGee is doing all it can to help overcome the international shortage of petroleum products. If its geophysical surveys are as accurate in the future as they have been in the past, and with a minimum of bad weather, much can be realized in exploring and recovering the huge oil reserves that are obviously in existence in this off-shore area of southern Louisiana. ★★★

Fuel and steam economy*

By MERRILL BERKLEY

Berkley Engineering and Equipment Company

THE object of this paper is to highlight the instruments and controls available in today's market to aid in reducing steam waste and to conserve fuel in the average-sized industrial steam boiler plant. This discussion will not include the extension and elaboration of this type of equipment for central electric generating stations and other highly developed steam power plants, since it is not in our present interest to concern ourselves with the highly technical aspects of instrument application.

Let us consider a steam plant, which can be briefly described as consisting of one or more boilers that convert heat into steam, which is discharged into a steam header or main steam line and is carried to the steam-consuming units.

As the steam requirements for the various items of equipment for power or process purposes is normally beyond the control of the men who operate the boilers, this steam load is known as the independent variable in any steam generating system. In order to balance this steam demand at the boiler, we have what we can call a dependent variable, which is the heat input in terms of fuel and air, and this, of course, can be directly under the control of the boiler operators.

The fundamental problems resulting from attempts to control efficiently heat input to balance steam load are several in number, and they are simply classified as: (1) Steam pressure; (2) combustion; (3) load distribution, and (4) steam distribution.

First consideration, most naturally, is given to steam pressure, primarily because almost all steam consuming units are designed to operate with a constant steam supply pressure. For example, turbines and engines are affected in both capacity and efficiency by variations in steam pressure. Also, manufacturing and commercial processes are affected in efficiency and uniformity of product by steam pressure variations. One industry-wide example of trouble resulting from steam pressure variations is to be found in the laundry business. Several pounds drop from the normal 100 psig pressure that all laundry equipment has been designed for, will slow down press unit operators and the large flat work ironers by as much as 50 per cent in producing properly dried and ironed sheets, shirts, and other laundry.

It is quite obvious that the first and basic problem in boiler operation is to control the heat input to the boilers in balance with the steam load to maintain a constant steam pressure.

In converting fuel and air into heat to provide the required input to the boiler, certain losses occur that are due largely to the sensible heat carried away in the products of combustion and the possibility of incomplete combustion of the fuel. These two losses are controllable, and they can be reduced to a minimum by maintaining the proper ratio of fuel to air. This, then, is our second problem in controlling a boiler—to maintain the fuel-air ratio that will give the maximum combustion efficiency.

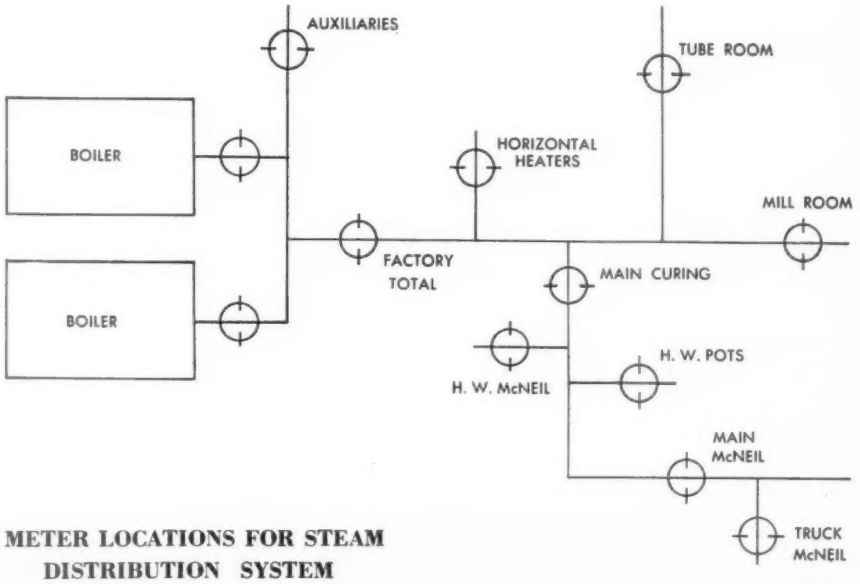
Perfect combustion has been defined as "the complete oxidation of the combustible matter with minimum air supply." Combustion is a chemical change in the relation of the elements contained in the fuel and the oxygen of the air. Fuel, whether it is a solid, liquid, or gas, contains combustible matter, principally carbon, the oxidation or combustion of which creates or generates heat.

When all the combustible material in the fuel has been united with a sufficient amount of oxygen in the air, the fuel is completely burned and all the heat has been liberated. Every atom of carbon has united with two atoms of oxygen forming a gas known as carbon dioxide (CO_2). If the supply of air is insufficient and there is not enough oxygen to combine with the elements of the fuel, some atoms of carbon will combine with only one atom of oxygen, and the resultant gas will escape in the form of carbon monoxide (CO), and this represents a direct fuel loss because considerably less heat is liberated in forming carbon monoxide in comparison to the heat liberated in forming carbon dioxide.

If we consider the opposite effect where the supply of air exceeds the minimum requirements for good combustion, this extra air merely dilutes the products of combustion and the heat required to raise this free air from room temperature to the temperature of the flue gas leaving the boilers will be lost in the escaping gas. As the amount of heat carried off in the stack is very nearly proportional to the volume of the flue gas, it is important that this volume be kept as low as possible.

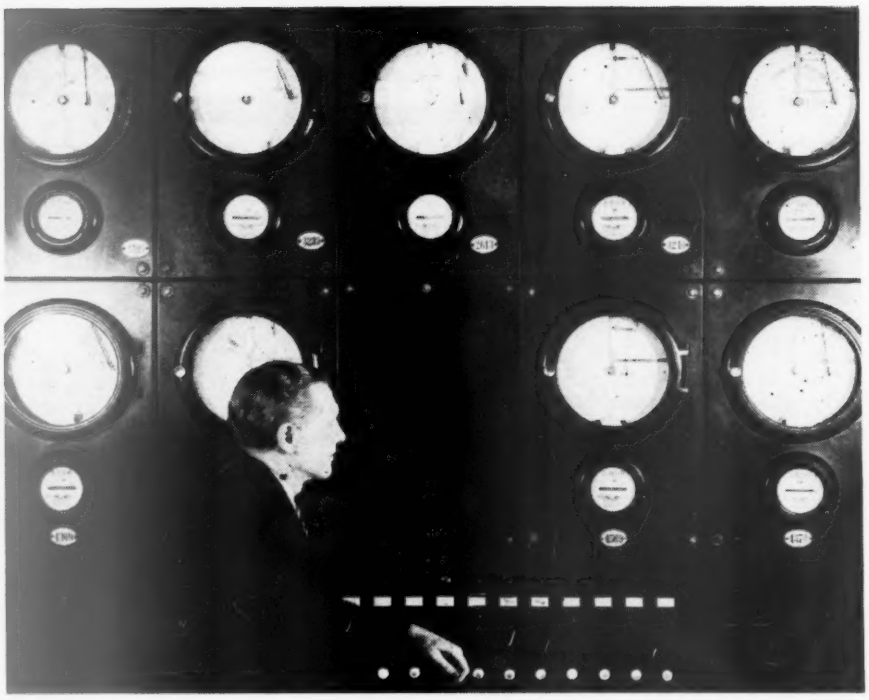
Of these two evils, carrying an excess amount of air for fuel burning is more common than maintaining an insufficient air supply. The amount of fuel wasted due to the heat lost up the stack is the largest of all controllable losses, and, in the average boiler room operating without instruments, this waste falls between 20 and 30 per cent of the total heat in the fuel, and it can and should be reduced to a point near or below 15 per cent.

The degree of efficiency of fuel combustion is most easily and accurately determined by a CO_2 or carbon dioxide meter. It provides a record that is available at all times to the men in charge of the boilers, and will show them whether or not the fire is being maintained properly. The customary method of analyzing flue gas for CO_2 employs the fundamental Orsat principle whereby volumetric absorption of CO_2 is read directly on the indicator or recorder in terms of per cent CO_2. Boiler operators attempt to maintain a natural gas-to-air ratio that will maintain 9½ to 10½ per cent CO_2 depending on firing rate, and from 12 to 14 per cent CO_2 for fuel oil.



METER LOCATIONS FOR STEAM DISTRIBUTION SYSTEM

*Presented before Southern California Meter Association, Los Angeles, November, 1947.



In the modern industrial plant, almost all the characteristics by which power economy may be evaluated are measured automatically. Study of these measurements by competent engineers constantly points the way to more efficient use of steam. The pictures shown here were taken in the U. S. Rubber plant at Los Angeles, and the gentleman examining the meters is W. E. Chinn, chief power engineer.

Another factor besides a CO_2 meter in obtaining maximum combustion efficiency is the proper regulation of draft conditions in the boiler. To maintain accurately the correct draft for varying load conditions, the boiler operator must have a complete picture of actual draft conditions in the combustion chamber and in the stack. The most efficient draft to use can best be determined in conjunction with a CO_2 recorder to show the efficiency of combustion, and a steam flow meter to show the load on the boiler. Then, the draft that gives the highest percentage of CO_2 without carbon monoxide (CO) and carries the steam load without dropping steam pressure is the draft that should be used. It is very often the case that when all boilers are connected to a common stack that one of the boilers, usually the one closest to the stack, will get the greatest amount of draft, and provision is always made to overcome this by controlling the damper in proper degree as indicated by the draft instruments.

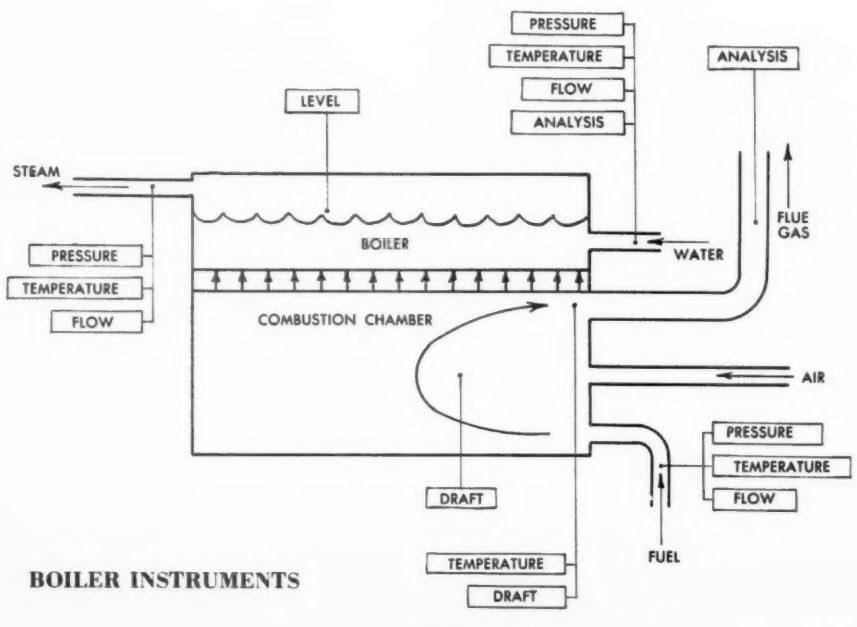
Where draft indicators should be connected depends in large measure upon the individual boilers, but, in general, when boilers are fired under natural draft conditions, it is well to know the draft in the furnace and at the point where the flue gas leaves the boiler. Windbox pressure measurement is necessary whenever forced draft is employed. One of the best arrangements for reading draft and pressure indications is to be had in the multipointer unit assembly, which provides for easily read vertical scales in side-by-side mounting for instantaneous reading and comparison of the different scale values.

Irregular CO_2 and draft readings indicating inefficient combustion can be traced to one or more of the following troubles:

1. Boiler damper is loose on its shaft and flops back and forth on its axis.
2. Damper may not be properly set.
3. Air may be filtering into the combustion chamber and upper boiler passes because the furnace walls are not tight or well covered.
4. If draft fans are used, these may not be regulated properly.
5. An accumulation of soot on boiler walls and tubes offers a rough surface to gases moving through the boiler and it may even close some of the available gas passages.
6. Combustion space in the furnace may not be large enough to handle fuel, air, and combustion products to permit thorough mixing of the fuel and oxygen.
7. Burners may not be adjusted to mix the fuel with the air supply.

A third instrument that must be considered as an aid in effecting fuel savings is a flue gas temperature recorder, which in itself is one of the best indicators of the inside and outside condition of the boiler tubes. A coating of scale on the inside of a tube and a covering of soot on the outside act as heat insulators and prevent the maximum amount of heat from being absorbed by the boiler. Some examples of heat loss figures are as follows: 1/50 in. of scale will result in a heat loss of 5.4 per cent, and 1/16-in. scale thickness gives a loss of 12.6 per cent. Considering the heat loss figures for soot from another angle, if we had a clean boiler that was absorbing 80 per cent of the heat input, a medium deposit of soot would cut this figure to only 74 per cent, and a heavy soot deposit would bring this down further to 68 per cent. As the heat that is not absorbed remains as heat in the flue gas, abnormally high flue gas temperature will result. High flue gas temperature is also an indication of defective baffles in the boiler, which are not directing the flow of combustion products across the maximum available heating surface. Also, excess air for combustion will be indicated on this recorder as a higher than normal flue gas temperature.

These three instruments—CO_2 meter, draft gage assembly, and recording thermometer—actually fill two purposes. In the first place, the instantaneous indication of actual operating conditions is of value to the operator at any given time; and in the second place, the aver-



BOILER INSTRUMENTS

age figures of these instruments in coordination with steam and fuel flow measurements will provide all the necessary information for constructing a heat balance to give the average performance of steam generating equipment for any given period of time. This is an important part of steam plant engineering practice, but more often than not this phase of the work is totally neglected.

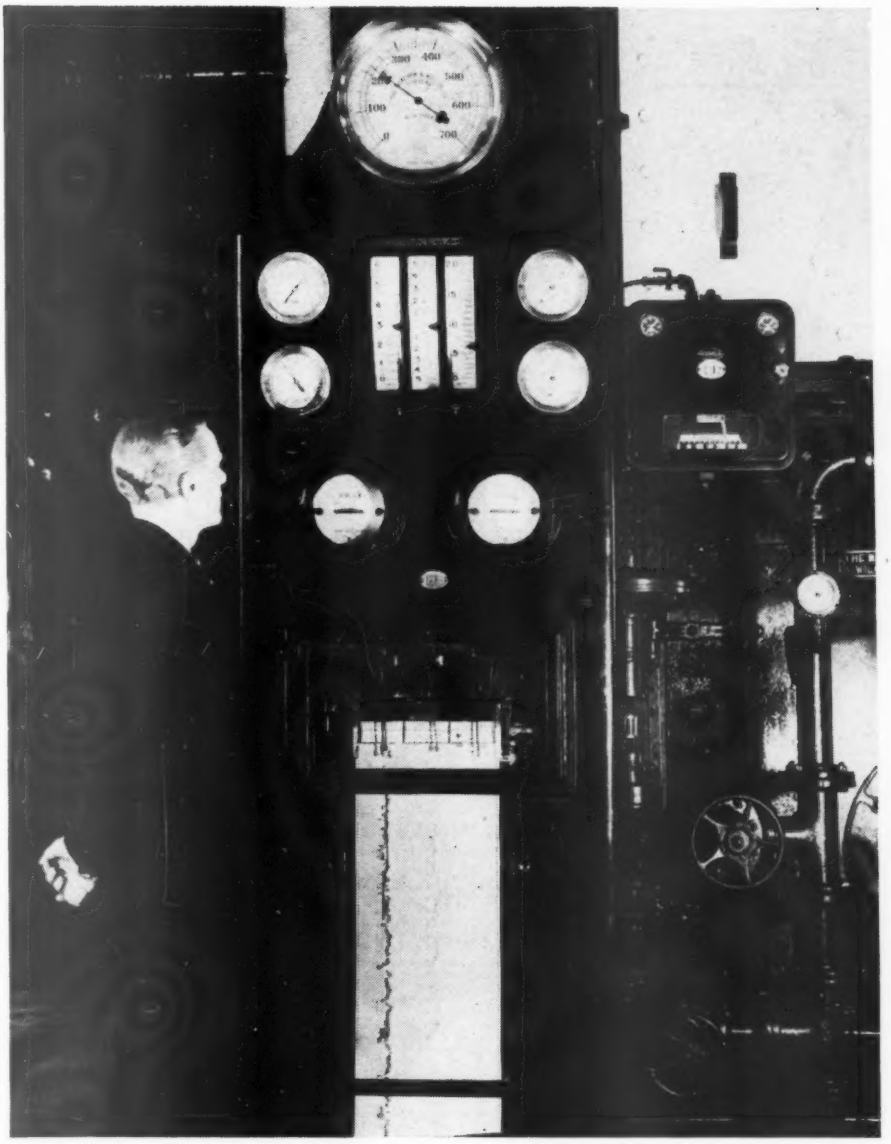
By studying the efficiency curve for any boiler, we find that the ratio of fuel consumed to steam generated is not the same at different boiler loads, and this brings up the matter of load distribution when more than one boiler in a plant is required to handle the total plant load. There is a definite range of per cent of rating at which a boiler can be run at high efficiency. Therefore, when operating two or more boilers it will be necessary to keep the boilers as a unit within this range to obtain the best plant operating efficiency. This is easily accomplished with a steam flow meter indicator on each boiler showing at just what per cent of rating they are operating. One of the important uses of a steam flow meter is to make possible a uniform distribution of load between the various boilers on the line. A second important use is to maintain the total number of units at the best operating load.

Should the steam load increase so that the boilers are operating at a point where the efficiency is materially decreased, the rating should be cut down by putting another boiler on the line. When the load drops, a boiler should be cut out of service or "banked" to maintain the proper load on those boilers remaining on the line. Of course, any possibility of doing this depends upon load requirements through the day.

A steam flow meter might be called the "load ammeter" of the boilers, and one such meter for each boiler is indispensable for correct operation, as they give the operator a continuous picture of the work being done by each boiler. Sudden overloads can be quickly discovered and the combustion rate increased before steam pressure falls off. Any drop in the load can be detected and the heat input reduced to prevent unnecessary fuel waste. Furthermore, an indicating meter showing the steaming rate of a boiler will indicate load changes far in advance of the steam pressure gauge indications.

Recording and totalizing steam flow meters perform a different function than an indicator, as the recorder is a curve-drawing mechanism designed to prepare a clear, continuous record of boiler steam rate on a chart. The flow totalizer, or integrator, gives the total amount of steam generated during any given time interval.

The graphic chart records of individual boiler operations covering a 24-hr period provide the chief engineer with a knowledge of the operation for the entire plant, and the totalizing meter, by giving the total of the steam generated by each boiler, shows, when compared with gas or oil burned, the amount of steam produced per 1000 cu ft of gas, or per pound or gallon of fuel oil. This item and other items entering into the cost of boiler operation will result in a figure representing the cost per 1000 lb of steam, which every engineer tries to keep as low as possible.



In conjunction with a carbon dioxide meter, a steam flow meter is used to show the load on the boiler and to determine the most efficient draft to use. The ideal draft is that which gives the highest percentage of carbon dioxide and carries the steam load without drop in steam pressure.

Thus far we have considered the use of instruments to tell the operator what each boiler is actually doing and what to look for when highest combustion efficiency is not being maintained, but this has been on the assumption that the operator adjusted his controls manually. It is a fact that human nature is not efficient at accomplishing the manifold duties of regulating all controllable variables simultaneously, and, therefore, combustion control systems have been devised to permit the boiler operator to function more as a fuel and air governor, a draft distributor, and load dispatcher.

Combustion control is a system of machinery designed to automatically operate and coordinate fuel and air requirements. Such a system will automatically maintain a constant steam pressure by controlling the heat input to the boilers in balance with the steam load by adjusting gas or fuel oil valves. It can maintain the highest combustion efficiency within practical limits by controlling fuel and air requirements in measured proportions and a fixed ratio over normal load ranges. It will also automatically maintain any desired load division between the boilers and automatically hold the correct constant draft in the combustion chamber when forced draft fans are employed.

A simple control arrangement consists of a master controller receiving the steam pressure and translating every tendency of this pressure to vary from a set point into air loading pressures for transmission to fuel regulators and air flow regulators. Where draft through the boiler is obtained by use of a stack of

Preview of the new

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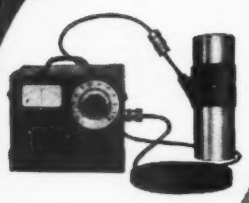

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sufficient height and capacity, or mechancially by using induced-draft fans, the air flow regulator is simply an operator for the boiler damper, which is located at the point where the products of combustion leave the boiler.

If air for combustion is forced into the boiler by a fan, another regulator is required in the system to maintain a constant furnace pressure by controlling air input at the burners.

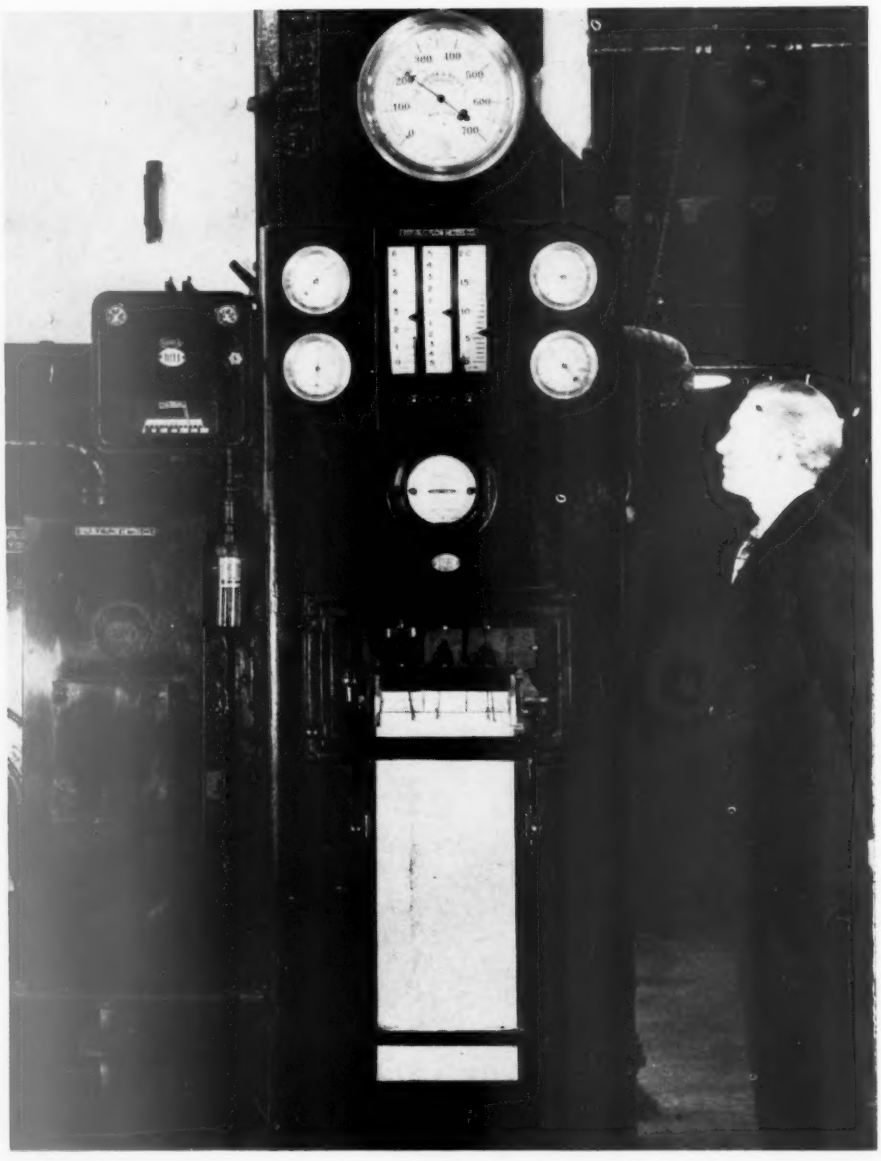
Now that we have equipped our power plant with instruments and controls to operate at the best efficiency, and we have reduced the cost per 1000 lb of steam to the irreducible minimum, just how much have we gained if the rest of the plant wastes it?

All the efforts and engineering ability that have been expended to produce more steam with less fuel can be lost by the wasteful use of the steam produced. Overall economies can be obtained by checking carefully the actual use and distribution of the steam. Often it has been found that steam is being used wastefully and unnecessarily merely because the steam valve is handy and the supply of steam apparently is inexhaustible.

This condition is especially true in plants where there is a variety of uses for steam. Usually the workers in each department are interested primarily in their own convenience and care little for the economy in those things for which they are not held responsible.

If a certain department uses large quantities of steam, it is only logical that that particular department ought to have the steam charged to its own operating account rather than against the cost of power. Most engineers realize this and have made attempts to apportion what is thought to be a just charge for the steam supplied. Although this helps relieve the power plant of some burden, it does not show how and when the steam is used.

The degree of efficiency of fuel combustion is most easily and accurately determined by a carbon dioxide meter. It provides a record that is available at all times to inform the boiler operator whether or not firing is being properly maintained.



Pipe lines used to move crude oil, petroleum products, and natural gas in the United States total about 380,000 miles.—*The Petroleum Data Book*, Dallas, Texas.

☆ ☆ ☆

The only accurate and reliable check against the use and abuse of steam by various departments is to install steam flow meters on the supply lines so that the steam can be measured and recorded and then charged to the department at a proper cost rate. This not only results in a fair and proper accounting of the cost, but it also eliminates wasteful and careless use of steam. There is also a moral effect of better operation and more care is taken when the workers know that what they are doing in the way of steam use is being put down in black and white on the meter chart.

The main function of flow meters installed on distribution lines is to show the total amount of steam used, and this is of first importance in getting the cost of steam for separate divisions or processes in the plant. Ways of reducing steam consumption by various departments can be brought to light by studying the peculiarities of the steam consumed as revealed by the graphic record prepared by the flow recorder. The chart record can be used to advise the different departments where, when, and why steam can be saved, because by using the chart in conjunction with production figures, it can be shown why the department used more steam than necessary for a certain period.

Steam flow meters and combustion indicating instruments are an absolute necessity in any industrial plant where maximum economy in fuel and steam consumption is desired. Continuous measurement and analysis is the only way to assure that high efficiency is being maintained. First importance must be given to maintaining constant steam pressure so that steam consuming machinery may operate at its highest efficiency and capacity. Fuel can be saved by analyzing the products of combustion as a guide to maintaining the best fuel-air ratio for boiler load range in combination with draft gage indications, and by measuring stack gas temperature for an indication of internal boiler condition. A combustion control system and steam flow meters will eliminate guesswork on the part of the operator in regulating heat input variables to achieve highest individual boiler efficiencies, and lastly, but of equal importance, steam can be saved by using meters to know when, where, and why steam is used in other parts of the plant.

This equipment is designed to elevate the man on boiler duty to an efficient maintenance operator and supervisor—duties that no machine can ever perform.

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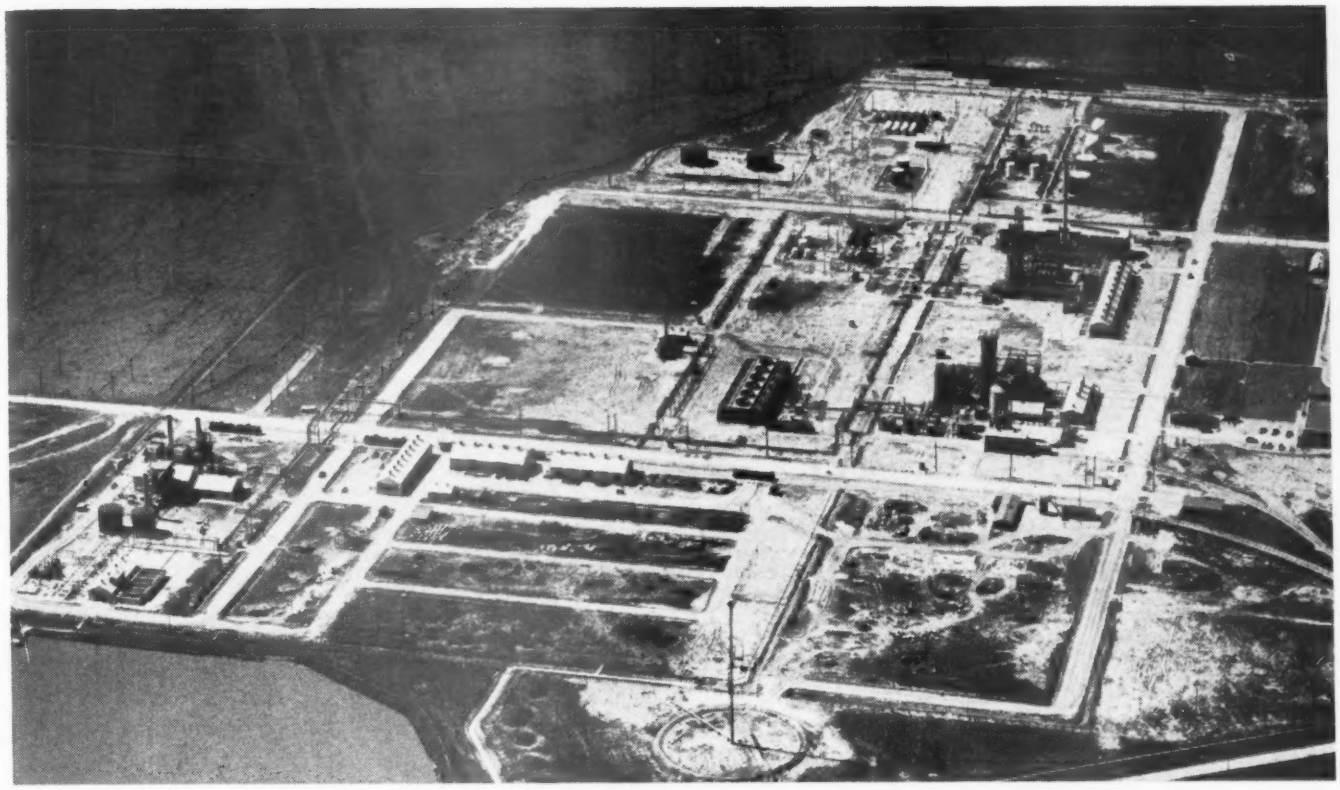


Aerial view of plant recently completed by Jefferson Chemical Company, Inc., situated near Port Neches, Texas, on a tract of approximately 1100 acres. The new unit occupies about 100 acres leaving room for expansion.

New chemical plant on Gulf Coast

THE plant of Jefferson Chemical Company, Inc., near Port Neches, Texas, is now in full commercial operation. The plant manufactures ethylene glycol, ethylene oxide, ethylene dichloride, and other products. The installation represents another sizable addition to the rapidly-growing Gulf Coast chemical industry.

Both ethylene glycol and ethylene oxide are in extremely short supply, and the output of the new plant should aid materially in alleviating the shortage. Best known for its use in permanent-type automobile anti-freeze, ethylene glycol is also used extensively in the manufacture of cellophane, resins, and low-freezing dynamite, in processing textiles and tobacco, and as an ingredient in brake fluids. Ethylene oxide is a chemical intermediate employed in making synthetic rubber, detergents, plastics, and various other products.

Formed in November, 1944, by The Texas Company and American Cyanamid Company, Jefferson operates as an independent organization, with its own technical and research, engineering, sales, accounting, and general administrative departments. The company has embarked upon a broad program of research, and is expected to engage increasingly in the manufacture of intermediates and bulk chemicals from petroleum. For the present, it is selling only in tank car quantities, although it is anticipated that provision for shipment in smaller containers may be made later.

Jefferson's plant is situated on a tract of approximately 1100 acres on the Neches River, which affords deep water transportation to the Louisiana - Texas Intracoastal Waterway and the Gulf of Mexico. The plant employs as a raw material refinery gases produced by The Texas Company's refinery at Port Arthur, which are brought by pipe line to the Jefferson plant approximately 5 miles away. American Cyanamid has acquired about 900 acres adjoining the Jefferson installation, but its plans for use of the ground have not been announced.

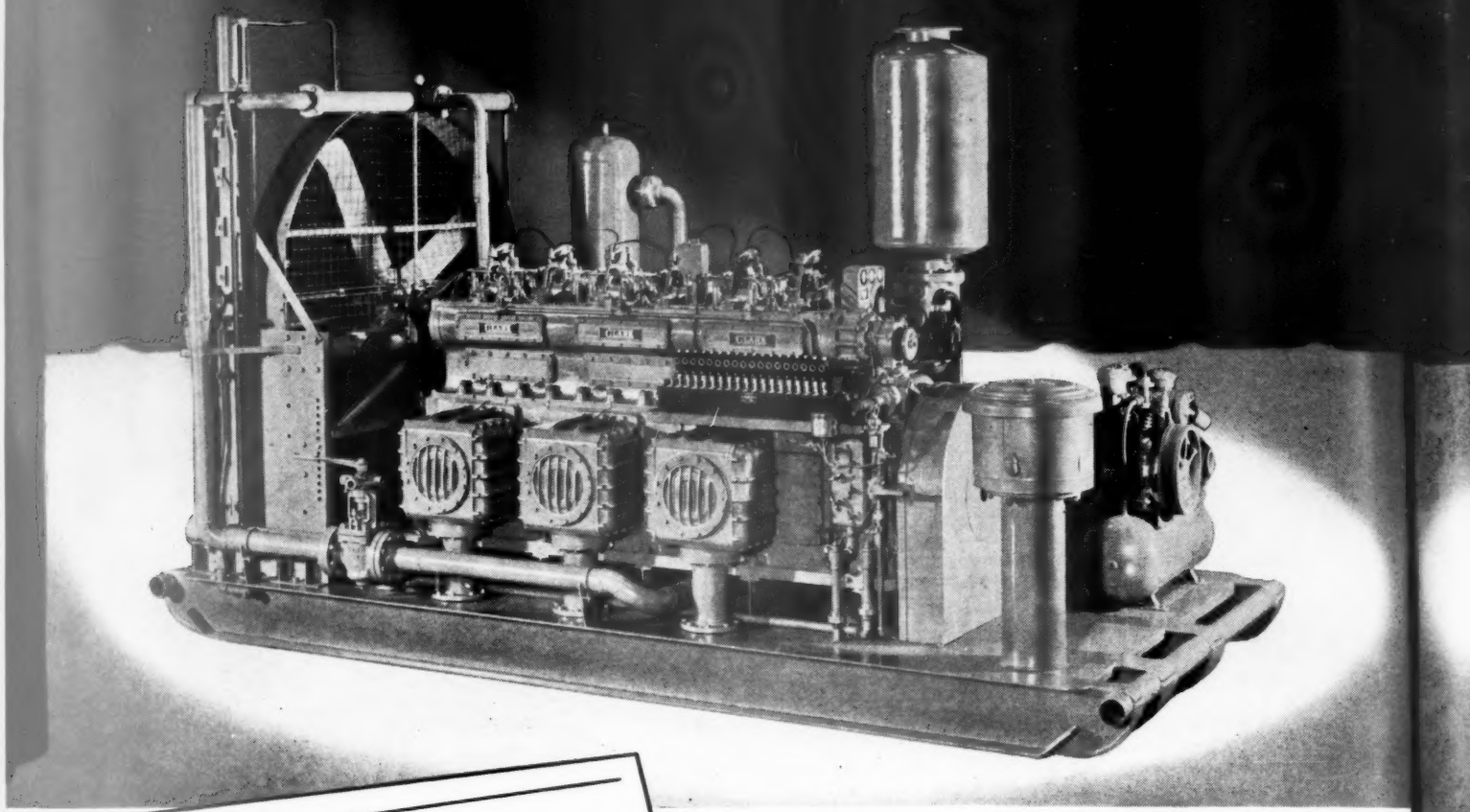
● **Provision for expansion.** Of the 1100 acres in the Jefferson tract, the present plant occupies about 100 acres. In laying out the plant, ample provision was made for expansion. The central block in the plant was allocated to process units and to spaces for cooling towers and intermediate surge tanks. This area is situated between two of the main plant roads and can be extended, as the need arises, for about a mile.

The space on one side of this process block is given over to water treating facilities, the boiler and power plant, warehouses, shops, and material storage. This area can be extended to match extension of the process block as the plant grows.

On the other side of the process block is an area allocated to storage tanks and tank car loading facilities. Beyond this, there is an additional area that later can be used for packaging and drum handling.

Jefferson's tract includes more than half a mile of frontage on the Neches River, connected with the plant proper

Tulsa Exhibit Spotlights THESE N



CLARK "Midget Angle" COMPRESSOR

A "Packaged" Compressor Station

Introduced less than two years ago, the Clark "Midget Angle" Compressor has been received by the industry with enthusiastic approval. Its quick adaptability to a variety of jobs, its ease of portability from one job to another and its rugged ability to do a real pressuring job are responsible for this wholehearted acceptance by oil men.

Mounted on skids for short-duration jobs in the field, or permanently installed, the Clark "Midget Angle" makes an ideal unit within its established powers, from 75 to 300 B.H.P. It insures close control of pressure and its perfect running balance permits a wide range of speed with a minimum of vibration.

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For High Pressures and Large Volumes

Here is the economical answer to the need for greater capacity compressors.

Clark Multi-Stage Centrifugals have been designed specifically for high pressure and large temperature differential duty.

As illustrated above, the new Clark design provides for through drive, which permits two or more compressors to be connected in line, with one driver. Extreme economy of space, installation and operating cost is thus achieved.

Standardized design permits use of interchangeable parts and easy adaptation to different types of service as well as speed in filling orders. Capacities from 2,000 to 60,000 c.f.m. and pressures up to 300 lbs. can be handled.

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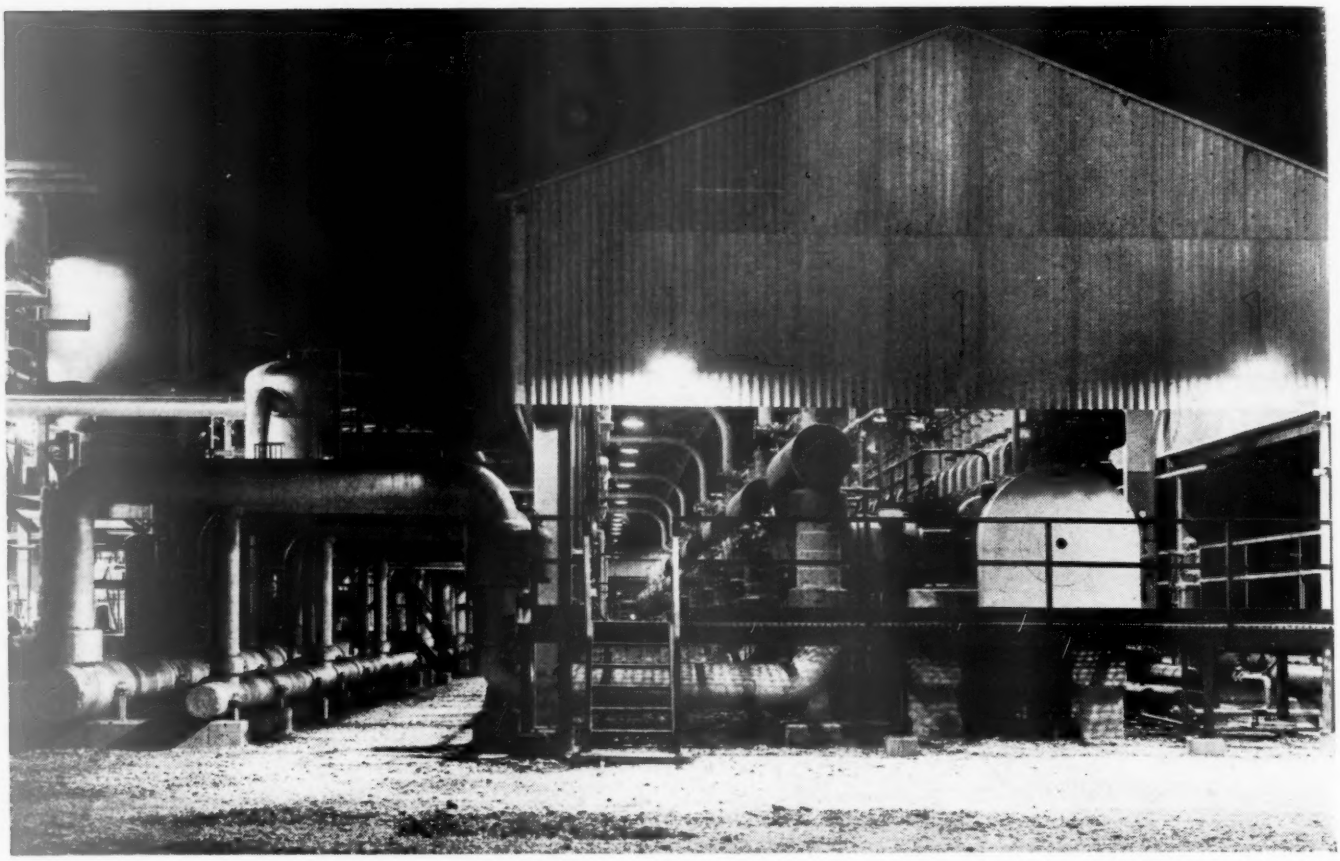

Night view of the compressors in the ethylene unit showing suction and discharge piping. Aisle at left is a typical illustration of provisions made in the layout for ease of access for maintenance and fire protection.

by a strip of land, which will permit future installation of pipe lines to carry finished products down to a dock for water shipments.

The initial plant layout includes a large area for administration buildings, such as laboratories, an office building, a cafeteria, and a locker building. One wing of the laboratory has already been built, and for the present a portion of this building is being used for plant offices. It is planned at a later date to build a separate office building, and to add additional wings to the laboratory building as requirements for laboratory space increase. The initial wing of the locker building and gate house has been built, and preliminary designs have been made for additional wings, including one for first aid and personnel. Preliminary designs have also been made for a cafeteria.

● **Advantages of the site.** The plant site was selected only after a very thorough engineering study of a number of locations in the general Beaumont-Port Arthur area. One of the major factors that resulted in a decision for the site finally selected is its elevation. Although only about 15 ft above sea level, the plant is one of the highest in the gen-

Night view of the purification section of the ethylene unit.

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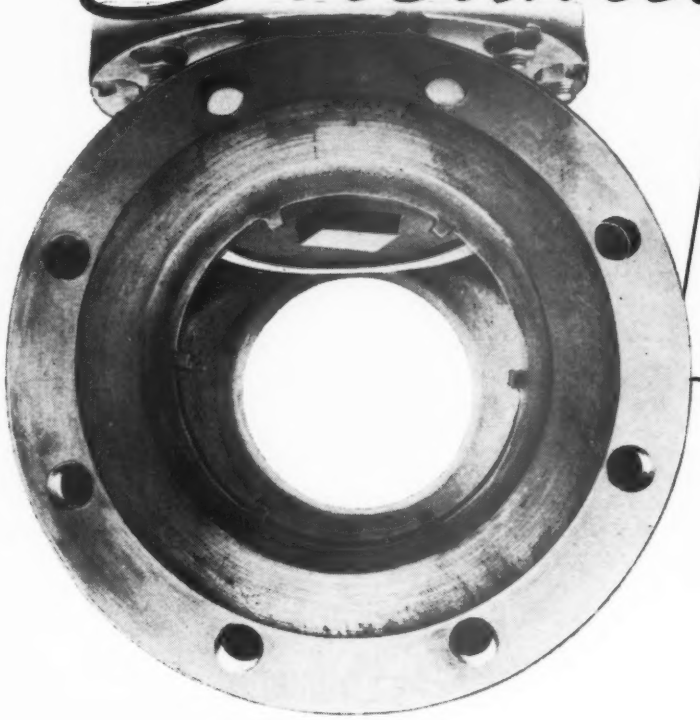

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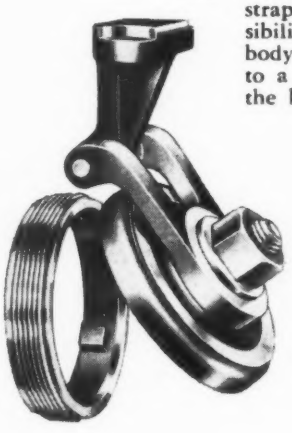
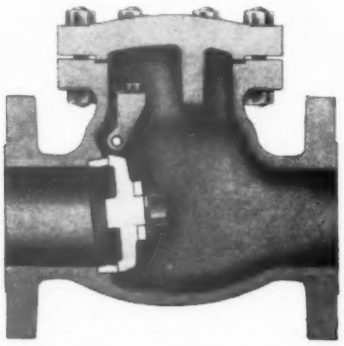
Bodies of **OIC** Steel Swing Check Valves are designed to permit unobstructed flow when the disc is in the wide open position . . . port-to-port streamlined internal contours reduce turbulence to a minimum, keep pressures to a maximum! And when the disc is closed you get a positive, firm closure, because careful calculation of bearing surface dimensions and tolerances permit the disc to swivel freely and to adjust itself easily to a leak-proof seat under a minimum of pressure.

It is easy to examine an **OIC** Steel Swing Check Valve. The complete disc assembly may be lifted out of the valve simply by removing the two mounting screws which secure the unit to the body. All internal valve parts are readily accessible and removable through the cap opening. Horizontal or vertical position — it makes no difference to **OIC** Swing Checks — because the seat is inclined at a five degree angle from the vertical, assuring dependable and efficient operation in either position!

For free-flowing steady pressure in any application, you can trust the products of **OIC**, pace-setter in valves!

Hinge pins with the stamina to stand up under long, hard service bear only upon the strap and strap holder—eliminating the possibility of sticking or seizing in the valve body. Free and easy motion that holds friction to a fraction—no chance of leakage through the body at the hinge pin.





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eral vicinity. As a result, drainage has offered no difficulties, and in addition all the equipment was installed on spread footings, without use of any piling whatever.

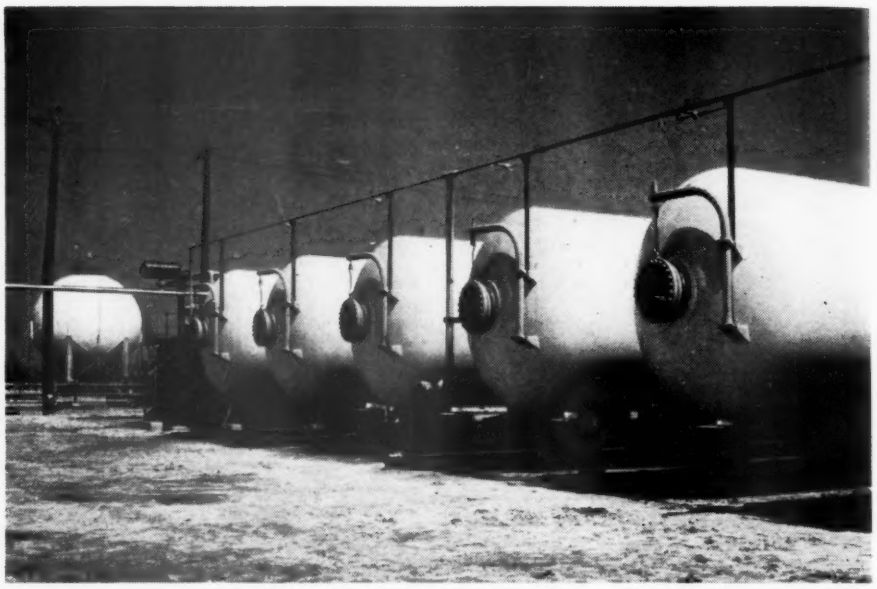
Other advantages of the site are accessibility to the Neches River, which has a channel deep enough to accommodate ocean-going vessels, and nearness to the Port Arthur refinery of The Texas Company, source of the refinery gases that constitute one of the plant's important raw materials.

● **Process units.** There are three process units in the plant: (1) An ethylene unit, (2) a combined ethylene oxide and ethylene glycol unit, and (3) a unit to purify ethylene dichloride obtained as a co-product during the manufacture of ethylene oxide.

In the ethylene unit, the refinery gases obtained from The Texas Company are first treated with diethanolamine to remove carbon dioxide and hydrogen sulphide. This feed stock is then combined with the effluent from the cracking heaters, compressed, and separated in fractionating towers, some of which are operated under low temperatures requiring refrigeration for cooling and condensing. Propane and ethane are used as refrigerants.

There are a total of eight heaters installed, each containing 40 floor burners. The heaters are arranged in two banks of four each. Each bank has a common flue and in each of the two flues there is installed a waste heat boiler to recover all possible heat in the flue gas. Steam is generated in these boilers at 175 psig and is fed into the plant's high pressure steam system. Each flue also contains a heating coil for heating gas to regenerate two sets of driers that dry the feed entering the low-temperature fractionating towers.

The reason for installing so large a number of heaters is the necessity for periodic de-coking. The de-coking operation is carried out by burning the coke from the inside of the tubes by the proper mixture of steam and air, while maintaining the proper temperatures in the tubes.



A view of six of the ten chlorine storage tanks. The piping at the near end of the tanks is a portion of the water spray system which can be set in operation remotely in case it is necessary to cool the tanks. At the far end of the tanks there is a small horizontal surge tank connected into a run of the chlorine piping. This surge chamber is typical of many in the chlorine piping, and is to take care of liquid expansion as the temperature changes.

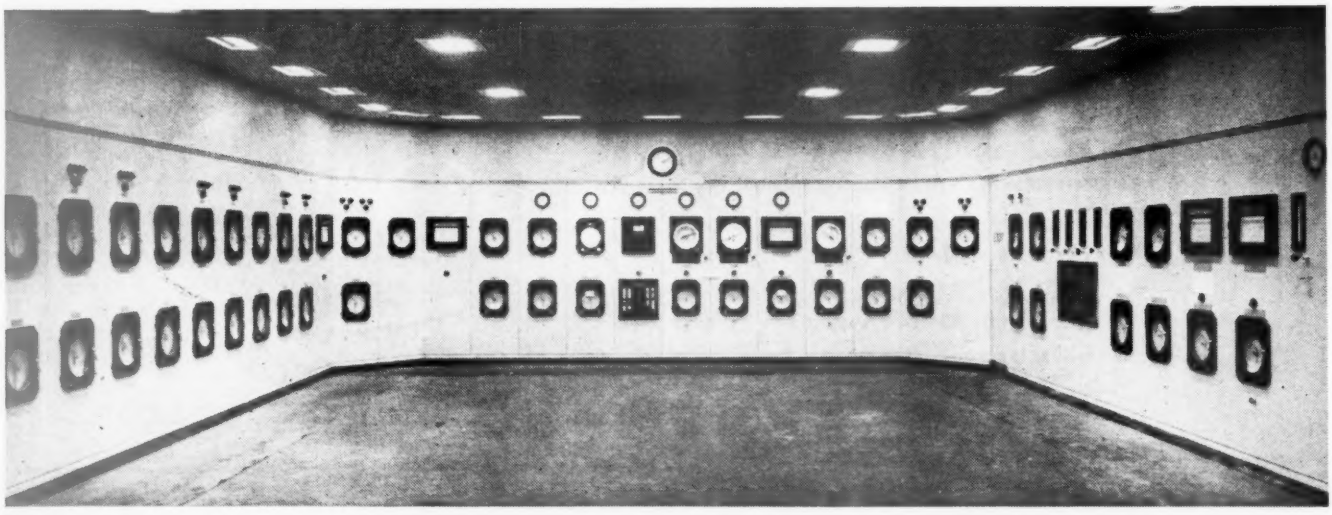
Ten angle-type, gas-engine-driven compressors are installed in the unit, six of them being used for propane compression in the refrigeration system and four for compressing the feed gas and the heater effluent gases.

The unit produces a purified ethylene stream, an aromatic distillate (high in aromatics), and a hydrocarbon polymer stream.

The ethylene oxide and ethylene glycol unit was designed after extensive pilot plant work done by Jefferson's technical and research department in their pilot plant at Port Arthur. Products of the unit are ethylene oxide, ethylene glycol, polythylene glycol (largely diethylene glycol), and a crude dichloride. The latter is purified in a separate unit by drying and distillation, a mixture of higher chlorinated hydrocarbons being obtained along with the purified ethylene dichloride.

● **Utilities.** Fresh water is obtained from a canal of the Lower Neches Valley Authority, which runs adjacent to the plant site, the required amount being pumped into an 18,000,000-gal. reservoir. Treatment of the water for the plant's domestic water system and process uses consists of precipitation with soda ash, alum, and clay, further treatment with chloride

Control room in the ethylene oxide and ethylene glycol unit has several rather unusual features, among which are an acoustical ceiling, light buff-colored panels to reduce eye strain, and the emergency exit seen at the far end of the right hand panel.



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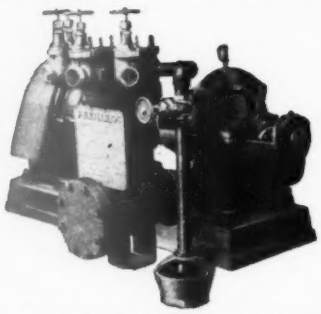

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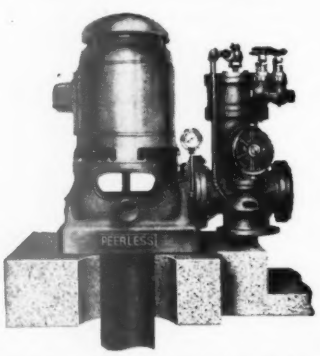

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Fractionating towers on ethylene oxide and ethylene glycol unit. Note the access platforms and tray removal trolley rails at the top of the towers.

and caustic, and filtration. Water fed to boilers is given an additional softening treatment.

A novel feature is that the chlorine used for water treating is obtained from large storage tanks situated in the plant's regular storage tank area. The plant's processes involve the use of large quantities of chlorine purchased in tank cars, and it was found that the saving in cost resulting from the use of this chlorine for water treatment, rather than cylinder chlorine, more than paid for installation of the long chlorine line required. The chlorine leaving the large storage tanks is vaporized by waste heat from one of the operating units, and sent to the water treating area as vapor. Chlorine cylinders are kept available for emergency only.

Power is supplied by the Gulf States Utilities Company, being brought in adjacent to the plant site at 33,000 volts and reduced to 2300 volts in a substation owned by Gulf States. The 2300-volt power is distributed within the plant and stepped down as required to 440 volts and 110 volts in four separate substations. Large motors are supplied at the full 2300 volts. Most of these motors are of the synchronous type, resulting in an excellent power factor for the plant.

Three boilers designed for 625-psi operation are installed, one of them being a spare. Steam is now generated at 175 psi for distribution throughout the plant; however, provision was made in the design for addition of turbo-generators at a later date. When these are installed, the steam pressure will be increased to 625 psi, and the necessary 175-psi and low-pressure steam will be obtained by bleeding from the turbo-generators.

The fresh cold boiler feedwater and condensate returned from the plant are deaerated and heated in a large deaerating heater of sufficient capacity for the operation of four boilers.

The boilers, as well as the induced-draft and forced-draft fans and the deaerating heater, are situated out-of-doors. Housing is provided only for the firing

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aisles, instrument boards, and feedwater pumps. A phosphate feeding system is installed to reduce boiler scaling.

Steam is distributed to the plant in lines supported on concrete piers at an elevation approximately 2 ft above the ground, except where the lines cross roads or railroads, where overhead steel supports are provided. This method of distribution results in materially lower initial investment and maintenance costs, and does not hamper access to the operating units. The air, condensate, and vapor chlorine lines are also run on the same piers.

● **Fire protection.** The fire protection system includes one steam-driven and one motor-driven fire pump situated near the water reservoir at an elevation that gives positive suction, and a 10-in. fire main terminating in an 8-in. loop serving the process and tankage areas. In addition to strategically placed fire hydrants there are several hose and foamite cart houses. In the main process units and the tankage area there are numerous monitor nozzles that may be operated quickly by one man. These monitors offer one of the best means of fighting the spread of a fire, for they can be put into operation quickly by the operator on the unit and can keep the temperatures low on equipment adjacent to the fire.

Nozzles for use on the fire hoses are combined stream and fog nozzles. It has been found that the use of fog nozzles materially aids in fighting hydrocarbon fires. Carbon dioxide extinguishers are placed throughout the plant. One main fire house contains foamite, chemicals, a portable foamite generator, blankets, asbestos suits, and other miscellaneous supplies.

● **Receiving and shipping.** In the area of the plant devoted to tankage and loading and unloading facilities, there are two tankcar racks, one for unloading liquid chlorine and the other for loading outgoing products. The liquid chlorine is unloaded by superimposing dry air under a pressure of 175 psig upon the liquid chlorine in the tank cars. The liquid chlorine is transferred to 10 chlorine storage tanks.

The chlorine unloading and storage equipment has some novel features, as follows:

Automatic shut-off valves that close when the tank cars are empty, at the same time ringing an alarm for the operator.

A method of heating the liquid chlorine en route to tankage in order to maintain sufficient pressure on the storage tanks.

The use of reflex type gauge glasses to determine the level of the chlorine in the tanks.

The installation of high level alarms in each tank.

A double relief valve system on each tank consisting of two shut-off valves, two frangible disks, and two relief valves. The shut-off valves are tied together with interconnecting gears so that when one valve is shut, the other must be open.

In the same area there are storage tanks for all the plant's liquid products, including spheres in which the ethylene oxide is stored under pressure.

● **Laboratory building.** The first wing of the laboratory building, which is already built, is of modern functional design. The upper floor is now used for plant offices, but the building is so designed that it can all be converted to laboratories later on. Construction is of reinforced concrete with a flat concrete slab for the second floor and roof, and brick and tile walls. Between the brick and tile there is an asphaltic waterproof membrane to eliminate any possibility of dampness from driving rains.

The entire building is heated by warm air circulation, and space has been left for future installation of summer air conditioning equipment. Two of the laboratories—the one containing the mass spectrometer and the one for low-temperature gas analysis—are already completely air conditioned, for both temperature and humidity.

The building is designed on the module system, each module being 7 ft wide. Partitions are of the movable type consisting of two sheet metal plates 3 in. apart with insulation between them. Use of the module system and the movable partitions makes it possible at any time to change the number of rooms or the size of any room.

Piping for the laboratory benches is carried in metal shadow boxes beneath the windows along each side of the building, with provision for taking off for laboratory benches at any desired point. Included in these shadow boxes are hot and cold water, distilled water, low-pressure steam, acid drains, compressed air, and electrical conduits. Space has been allowed for other piping if desired.

In one end of the laboratory building there is a large room that extends the full height of the building for large-scale equipment. A portion of the roof on this part of the building consists of precast concrete sections that can be removed to accommodate high fractionating towers or other similar equipment.

● **Research.** Jefferson's pilot plant is situated in one building of The Texas Company's refinery at Port Arthur. In addition, the company has a bench-scale research laboratory in New York. Both installations have been operating for several years, but plans are being considered for consolidating both pilot plant and bench-scale research activities at a location that is still to be selected.

★ ★ ★

Some haul!

Officers of Gregg County, Texas, are searching for a brawny person who stole a 94-ft, 18,000-lb oil derrick from a lease near Kilgore it was reported last month.

The dismantled derrick was owned by Albert Rast, Kilgore rig builder.

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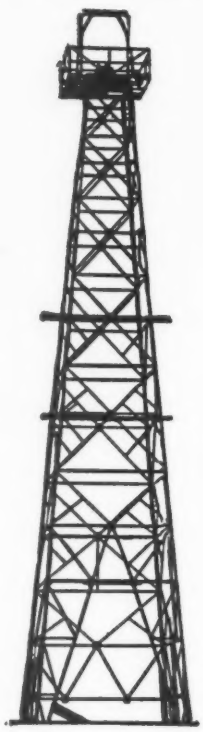

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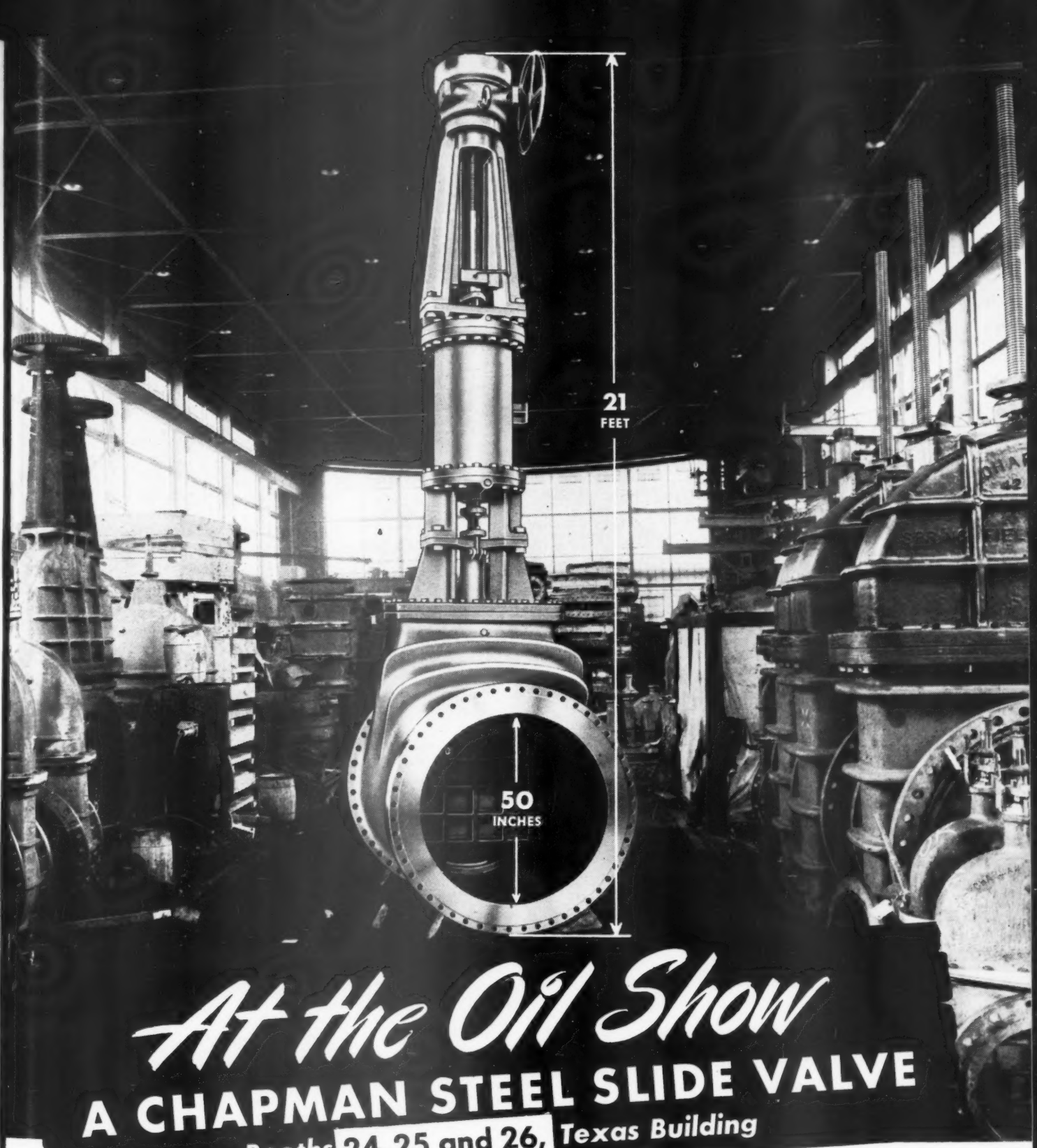

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Assemblage log—an aid to management

By KARL A. MYGDAL, Development Geologist, The Pure Oil Company

EXCLUSIVE

For some time there has existed a need for more convenient packaging of the information obtained during the drilling and completion of wells. With present-day technical supervision of operations the data collected on wells have increased in quality and type to a point where its handling and coordination is a serious problem. Instead of the primitive driller's log we now must evaulate logs showing sample descriptions, drilling time, hole size, radioactivity and electric characteristics, and must consider such information as drillstem tests, core descriptions, significant changes in mud, lost returns, stray gas zones, and the final production tests, often including bottom-hole pressure or productivity index surveys. The production man, geologist, petroleum engineer, and drilling supervisor are being submerged in an ocean of paper. It is often so inconvenient to handle the various long strips of unwieldy paper on which the information is presented by the collecting agencies that valuable information is overlooked or forgotten. The coordination of the data becomes a time-consuming and energy-wasting task on which important decisions must wait.

In most operating organizations, information is accumulated currently on the geologist's sample log. This log generally keeps fairly well abreast of the drilling operation and is a convenient place to note such things as drillstem tests, core descriptions, unusual incidents, etc. This practice takes care of the geologist in the field and of the field operating personnel in contact with him, but it often leaves uninformed other officers and departments of the organization that are concerned with the well. Despite the need for the geological log elsewhere, it is difficult to make copies of it. It is generally drawn on opaque material and the rock types are shown by color symbols. It is a costly and time-consuming task to copy such colored logs for other offices. They cannot be reproduced by blue print or photostat methods.

● **The assemblage log.** A solution to many of the problems suggested above is provided by a new type of well log developed by the geological department of The Pure Oil Company in the division office in Fort Worth, Texas. Representative sections of these logs are illustrated. Through its use the various interested offices of the division are kept reasonably up-to-date on the progress of the well. When the well is completed copies of the final log can be distributed as needed.

● **The gathering of information.** Information is plotted on the transparent original log in the Fort Worth division office on a current and routine basis by a draftsman who is responsible for this work. The log is drawn on a strip 6 in. wide of good quality tracing paper. All pertinent information shown on the daily drilling report is entered. This includes casing size and setting depths, amount of cement used, significant changes of mud, loss of returns, gas blowouts, etc. As special service company surveys, such as caliper logs, electric and radioactivity logs, or drilling rate logs are received they are traced onto the transparent original. Sample information and geological markers are provided by the geologist in the field who makes a duplicate of his field copy and mails it in. This copy, in sections of a few hundred feet each, is sent in every few days, as convenient. This sample log section also carries the drilling time recorded by the driller on the well. The draftsman copies the sample log onto the transparent original as soon as it is received. By keeping the log up to date currently a progress print can be made at any time that a need for it arises. When the well is completed all information that is of permanent value is assembled as soon as possible and added to the log for final reproduction and distribution. In areas of fast drilling where sample description may lag behind the other operations it may be desirable to issue progress prints without waiting for the complete sample log, especially if electric logs become available.

● **Drafting problems.** Free-hand work has been eliminated so far as possible. The most difficult reproduction problem under ordinary methods is that of the sample log. This problem is handled easily by using transparent overlay screens. The draftsman lays the transparent assemblage log original over the geologist's sample log and outlines in pencil, in generalized form, the rock units shown. Small details are omitted while preserving the significant rock changes. After inking the pencilled outlines he lays the appropriate screens on his log and trims around the outlines of his rock divisions with a special needle. This process is much faster than hand drafting and makes a neater reproduction.

The log heading is a printed form on tracing paper. On it the formation symbols are shown, together with the catalog numbers for the corresponding screen. It is joined to the body of the log with vanishing patch strips one inch wide. These vanishing patches leave no

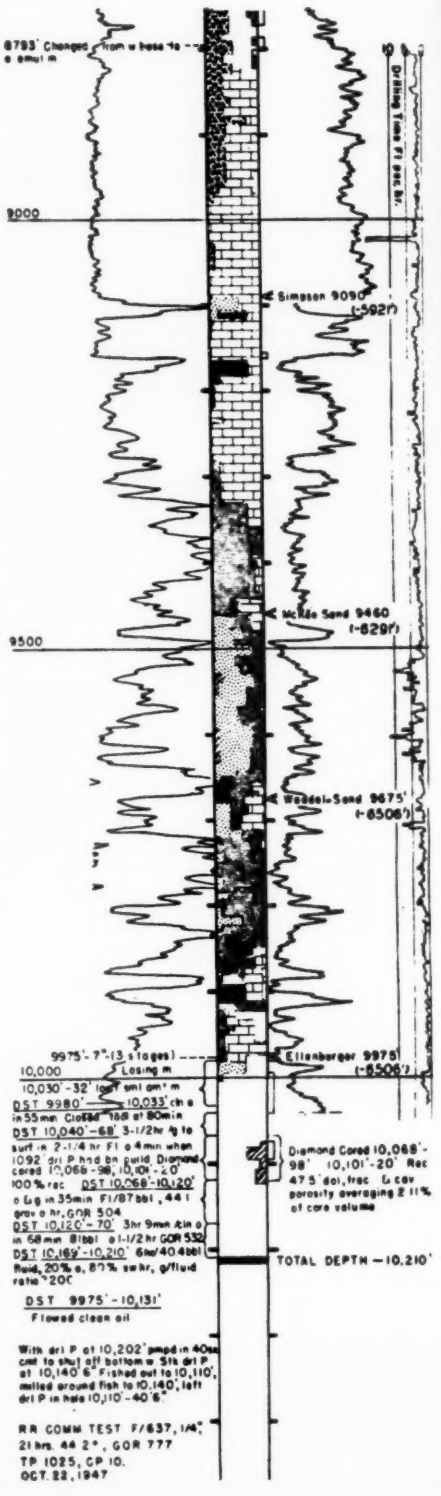

FIG. 1.

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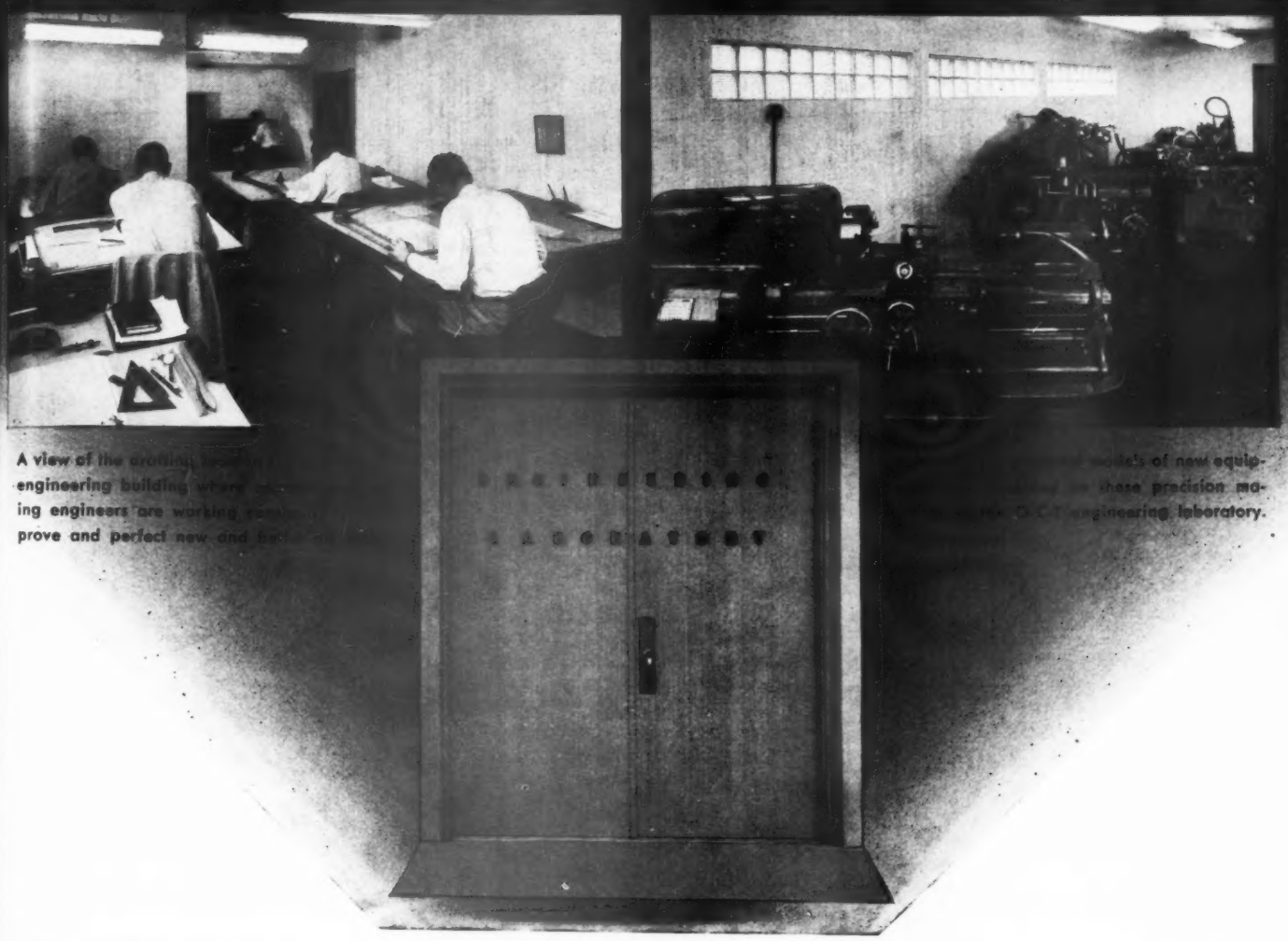

A view of the drafting [illegible] engineering building where [illegible] ing engineers are working [illegible] prove and perfect new and [illegible]

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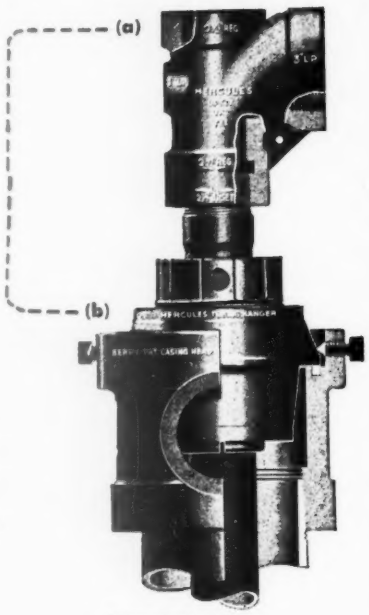

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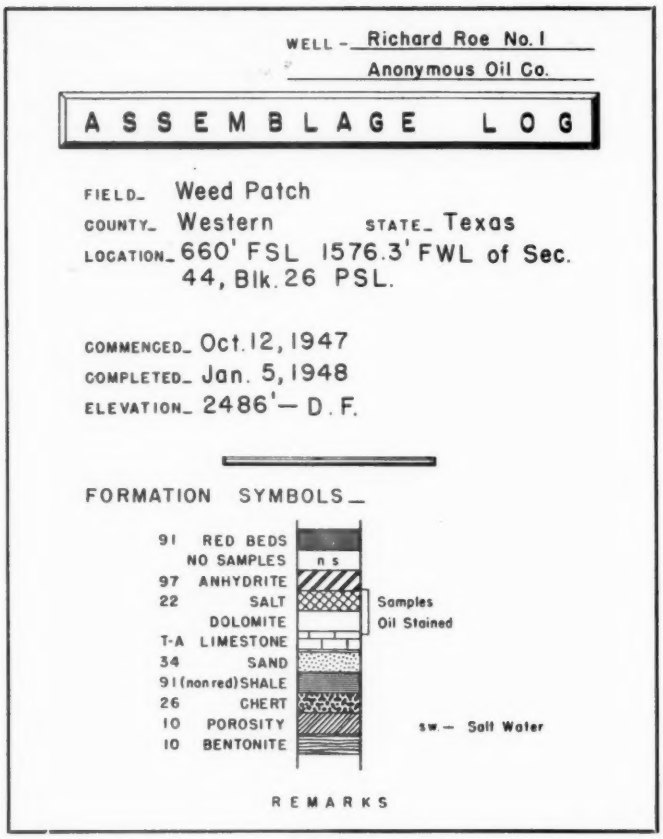

FIG. 2.

shadow when the log is reproduced. Radioactivity, electrical, and other special surveys are traced from the log provided by the service company after appropriate reduction in scale has been made. Lettering is done with a template.

● **Reproduction.** The adhesive on the overlay screen will come loose if too much heat is applied. It is therefore unwise to reproduce the assemblage log on the ordinary continuous rotary blueprinting machine. A better method is to make a negative Van Dyke on a vacuum printing frame and to then reproduce the Van Dyke as a blue line print on the rotary printer. Such a Van Dyke can be made at any time that progress prints are to be distributed. If only a single print is needed a black line ammonia print can be made by exposing the original log in a printing frame.

The first assemblage logs prepared by The Pure Oil Company were on 10,000-ft wells in West Texas. It has been found convenient to issue a progress print of the log after the intermediate string has been cemented at approximately 3200 ft. A second progress print is issued after drilling and testing the Devonian at approximately 7800 ft, and a final print is made after the well is completed in the Ellenburger at approximately 10,000 ft and after all logs and production test results have been received. The original log should be stored in tubes with a diameter of not less than 2 in. Folding or tighter rolling is apt to cause the overlay screen to buckle.

● **Distribution.** There are often advantages in having operating problems reviewed, or at least noted, by a number of persons provided the mechanics of the distribution and examination of the information can be done simply and efficiently. The assemblage log has helped in this desirable objective in The Pure Oil Company's Texas division. Logs are distributed to the field geologist and to the field superintendent, and in the division office are sent to the manager, the division superintendent, the production engineers, and the development geologist. In addition, copies are sent to the company's home office in Chicago.

Each operator will have different needs and distribution patterns, but all will find useful the reproducibility of the compiled well information.

● **Other uses.** Economies and convenience have resulted from cooperative exchange of copies of the electric and radioactivity logs. The exchange is sometimes arranged on a routine basis by a reproduction company that supplies copies to qualified members of the exchange agreement. It is possible that the assemblage log can be used for similar exchange of information in certain areas and under certain conditions. For example, in an oil field where operators are already cooperating in the exchange of all information, savings in time and money for all would be gained through the exchange of assemblage logs.

If such logs were available at low cost it would facilitate the construction of well profiles across oil fields. This procedure is very helpful in the analysis of structural and reservoir problems but is seldom utilized sufficiently. A major deterrent is the necessity of drafting the well log onto a sheet of tracing paper.

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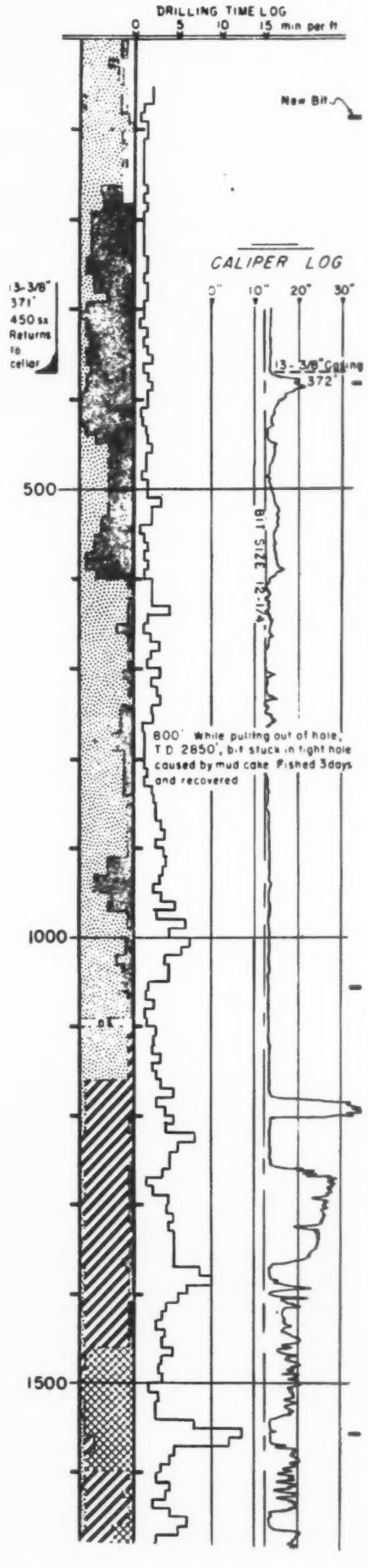
FIG. 3.


DRILLING TIME LOG
0 5 10 15 min per ft
New Bit
CALIPER LOG
0" 10" 20" 30"
13-3/8" 371' 450 sx Returns to cellar
13-3/8" Casing 372'
500
1000
1500
800' While pulling out of hole, T D 2850', bit stuck in tight hole caused by mud cake Fished 3 days and recovered

With assemblage logs available the necessary portions of the logs can be mounted on a sheet of cross-section paper and connecting lines drawn.

● **Scale.** The vertical scale of the logs is 1 in. to 100 ft. and has been found to be satisfactory. A larger scale such as 50 ft to the inch would make the log so long that it would be awkward to handle, whereas a smaller scale could not accommodate the information unless hand lettering were used.

The 1 in. to 100 ft scale can be reduced to a 1 in. to 200 ft scale, with a corresponding halving of the width of the log, and this scale is very satisfactory for well profile work. The lettering remains easily legible. As a specific example of the convenience of the 1 in. to 200 ft scale in well profile work, consider a typical pre-Permian oil field of West Texas: The pre-Permian section to be illustrated is 3000 ft thick and the field is two miles wide. It is desirable to keep vertical and horizontal scales equal. If the conventional 1 in. to 100 ft scale is used a profile would be 30 in. wide and 9 ft long, without allowance for margins. Such profiles are difficult to make, use, and store. The half scale ones are desk size and can be stored more easily while retaining all essential detail. Reproduction companies handling the present exchanges of electrical and radioactivity logs issue their prints as half-scale reductions of the original logs and are equipped to reduce the assemblage log. ★★★

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Electrical equipment for petroleum refining

By B. M. MILLS
General Electric Company

FIG. 1-A. Refinery type high voltage control ("Limitamp") group for outdoor use in a Pennsylvania refinery.

EXCLUSIVE

CONDITIONS in an oil refinery, insofar as presence of flammable gases is concerned, may vary from frequently or normally hazardous (as in an old centrifuge dewaxing plant) to non-hazardous (as in the power plant, outside the battery limits). Between these extremes are locations with a varying degree of probability or frequency of hazard, depending on such factors as distance from source of gas, direction of prevailing wind, height above ground, ventilation of housing, and absence of pits in which gas could settle.

Ten or fifteen years ago, there was usually no recogition of or allowance for the degree of hazard in the selection and application of control equipment: A location was either "hazardous" or it was "non-hazardous". If the location was designated as hazardous, "explosion-proof"[1]* control was specified. For low-voltage motors (440 volts) the problem was relatively simple. Oil-immersed or air-break starters designed and constructed in accordance with the Underwriters' Laboratories Standards for Class 1, Group D hazardous locations were available and widely used. For higher voltage motors (2300-4160 volts) completely oil-immersed starters (usually having an interrupting capacity of not over 50,000 kva) were used. Alternatively, automatic oil circuit breakers were completely immersed in a large oil tank, a manually operated oil circuit breaker, similarly immersed, was sometimes used as a disconnecting switch, and oil-filled bus ducts were sometimes installed.

Although apparently meeting the industry requirements for protection against corrosion and for hazardous locations, these devices and arrangements had some disadvantages that modern refinery practice and conditions have emphasized. They did not lend themselves readily to group installation, were often large and expensive, especially when disconnecting means were included, and were limited in short circuit interrupting capacity.

● **Influence of changing conditions on protective features.** With increased refinery electrification, increased use of purchased power, and "stiffer" distribution systems, it became increasingly difficult to hold the available short-circuit capacity down to the 50,000-kva level, and the need became apparent for higher interrupting ability in high voltage motor starters. This raised the question of how far completely oil-immersed construction should be carried out, and also whether the presence of such large quantities of oil as required for complete immersion did not, in itself, create a fire hazard and thus tend to defeat the purpose of such construction.

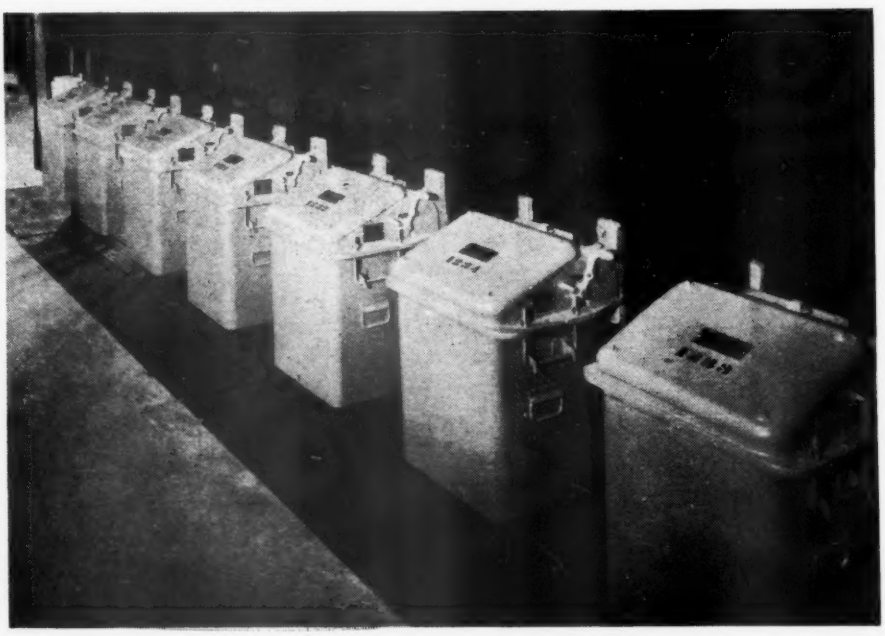
Furthermore, there was the not always recognized fact that the Underwriters' Laboratories Standards for oil-immersed control for Class 1, Group D hazardous locations applied only at 600 volts or lower, and there was no assurance that the construction was adequate for the purpose of making it "strictly Class 1, Group D."

These considerations led many to the conclusion that it was questionable practice to put any high voltage control, protected in any way known to the art, in a frequently or normally hazardous location.

● **Trend toward control centers.** During this same period, and especially during and subsequent to the war years, increasing labor shortage and increasing installation costs gave impetus to the trend toward group installation of control centers or rooms, with only the start-stop push buttons placed near the motors. For minimum overall installed cost, this meant factory assemblies of control cubicles, with common bus so that, when once in place, it was only necessary to connect the incoming power cable and the outgoing motor and control leads.

All these changes in conditions indicated the desirability of new protective measures. The location of the control groups, more or less remote from pump rooms and other normally hazardous locations, can, when properly selected, be considered as "infrequently hazardous."

FIG. 1. General-purpose corrosion-resisting high and low voltage starters in control room of a California refinery.



*See appendix.

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● **Protective features in control for infrequently hazardous locations.** For such infrequently hazardous locations, now designated in the 1947 National Electrical Code as "Class 1, Div. 2"[2] high voltage control is protected to the extent that all normally arcing parts are oil-immersed or in explosion-proof enclosures. Thus, contactors, interlocks, relays, auxiliary switches, field rheostats, and the like are oil-immersed or in explosion-proof boxes, whereas non-arcing parts, such as ammeters, voltmeters, busses, sealed fuses connection cables and disconnects so arranged that they never have to make or to break current, may be of standard construction.

Such a location would normally be free from flammable gas mixtures and could only become hazardous through some abnormal condition such as a broken pipe, a leaking tank, or the failure of a ventilating system. The chances of such a condition developing and causing gas to be present in the explosive mixture range (approximately 3-15 per cent gas in air) within the control cubicle at the same time that a failure in the control occurred (such that arcing will be present to ignite the gas) are considered to be remote.

Such a procedure places on the user a greater responsibility for selecting the location and adequately maintaining the electric equipment, but this has been found acceptable to many in the industry in return for the advantages it affords in space saving, lower installed cost, higher interrupting capacity, group installation, and probable greater overall safety. Electric control equipment designed and constructed for use in a Class 1, Group D, Div. 2 location is usually designated as "Refinery Type."

● **When and where "Refinery Type" control used.** It is always preferable to install general purpose control (Fig. 1) (or standard metal-enclosed switchgear) in a non-hazardous and corrosion-free location, but such locations are frequently not available in a refinery within reasonable distance of the motors. Under these conditions, the use of refinery type control in an infrequency hazardous location is advantageous. (Fig 1-A).

Rubber tire manufacturers use 80 per cent of all the carbon black made from natural gas in the United States. Carbon black is also used in the manufacture of ink and paint.—*The Petroleum Data Book*, Dallas, Texas.

☆ ☆ ☆

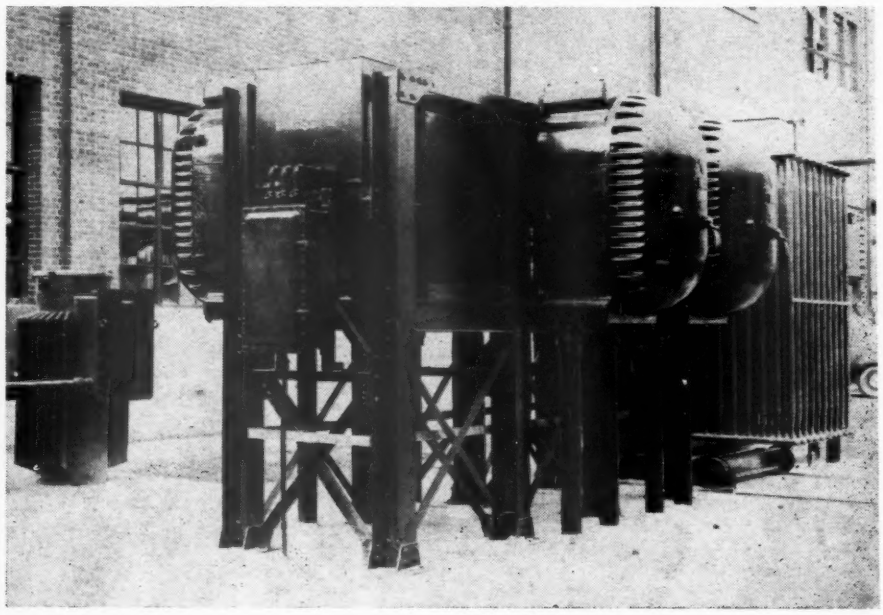
● **When not to use.** When conditions are more hazardous and fall in the category of Class 1, Group D, Division 1, it is preferable that no high voltage starters be installed in the area, at least where interrupting capacities in excess of 50,000 kva are required. If a safer, though more remote location (or adequately ventilated control room) is not available and it is necessary to put the starters within the area, motors should be made low voltage (440 volts) permitting the use of low-voltage starters of Class 1, Group D construction. Such starters are available up to and including size 6 for 440-volt motors including 400 hp.

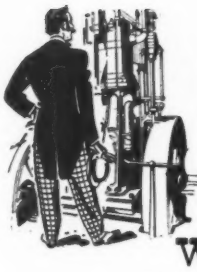
The availability of refinery type load centers (consisting of line switch, transformer, and racked-up explosion-proof low-voltage feeder breakers or combination motor starters), (Fig. 2), facilitates the use of low-voltage motors and control by shortening the necessary runs of low-voltage, large copper cable. Low-voltage oil-immersed or air-break starters in racked-up control groups are also available and widely used (Fig. 3).

● **Appendix.**

1. For an air-break starter, this means that the enclosing case is designed and constructed to withstand an explosion of a specified gas, or vapor, which may occur within it, and to prevent the ignition of the specified gas, or vapor, surrounding the enclosure by sparks,

FIG. 2. Typical refinery type load-center, in a refinery in Mexico.





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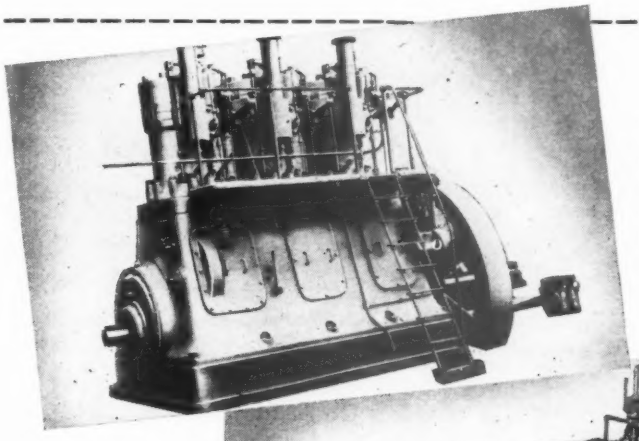

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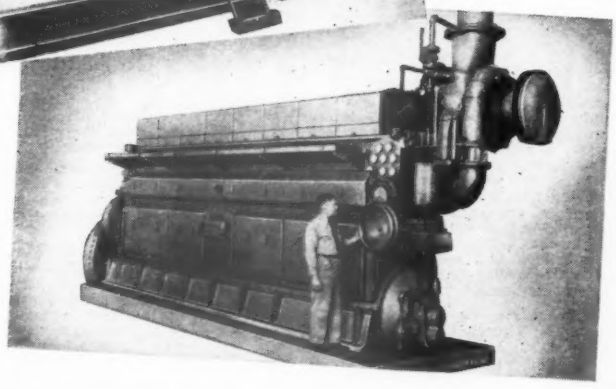

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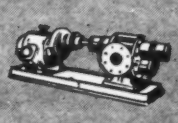
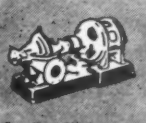


Oil Transfer Pumps



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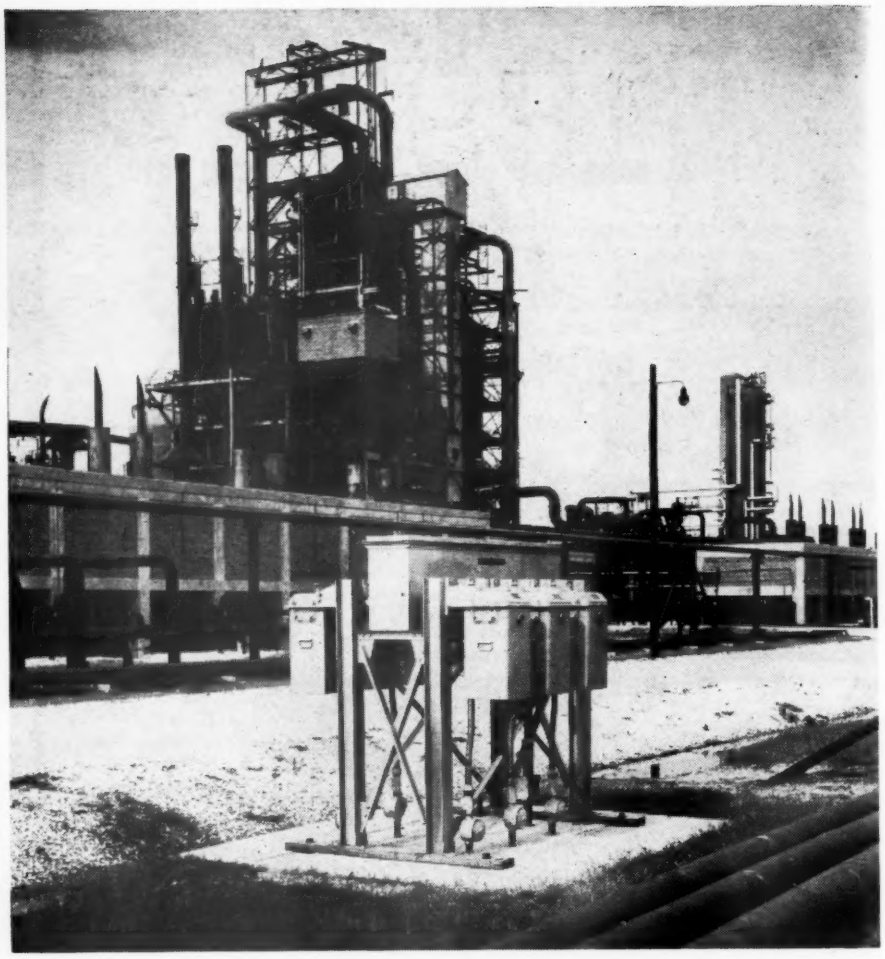

FIG. 3. Racked-up unit of oil-immersed Class 1, Group D low voltage starters installed outdoors in a Southern refinery.

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or explosions of the specified gas or vapor that may occur within the enclosure. For an oil-immersed starter the Underwriters Laboratories standards require that all electric contacts, bolted and soldered joints, and any other part that might produce a spark, be located sufficiently below the surface of the oil to prevent any arc or spark from igniting the specified gas, or vapor, that may accumulate above the oil level. The tank is made oil-tight but does not need to have sufficient strength to withstand an explosion, as in the case of the air-break type.

2. Now designated as Class 1, Division 2, in the 1947 National Electric Code, Article 500, Paragraph 5004. Class 1 locations are those in which flammable gases, or vapors, are, or may be, present in the air in quantities sufficient to produce explosive or ignitable mixtures. Class 1 locations shall include the following:

a. Class 1, Division 1, Locations (1) in which hazardous concentrations of flammable gases or vapors exist continuously, intermittently, or periodically under normal operating conditions, (2) in which hazardous concentrations of such gases or vapors may exist frequently because of repair or maintenance operations or because of leakage, or (3) in which breakdown or faulty operation of equipment or processes that might release hazardous concentrations of flammable gases, or vapors, might also cause simultaneous failure of electric equipment.

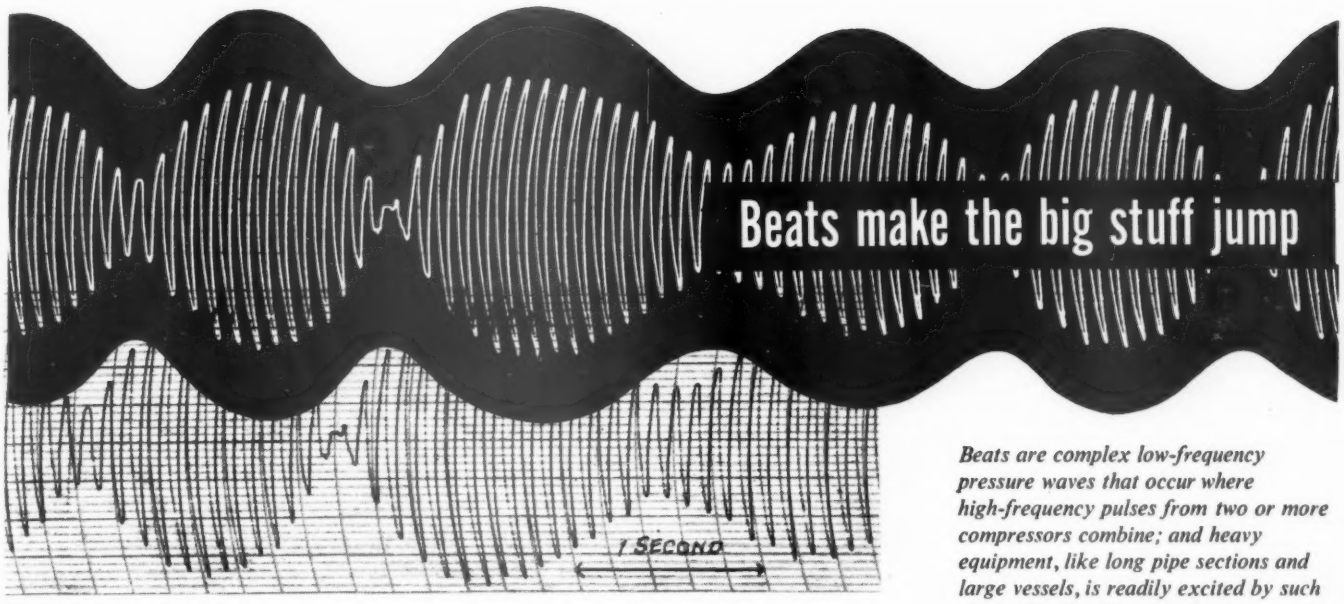
This classification would usually include locations where flammable volatile liquids or liquefied flammable gases are transferred from one container to another; interiors of spray booths and areas in the vicinity of spraying and painting operations where volatile flammable solvents are used; locations containing open tanks or vats of volatile flammable liquids; drying rooms or compartments for the evaporation of flammable solvents; locations containing fat and oil extraction apparatus using volatile flammable solvents; portions of cleaning and dyeing plants where hazardous liquids are used; gas generator rooms and other portions of gas manufacturing plants where flammable gas may escape; pump rooms for flammable gas or for volatile flammable liquids; and all other locations where hazardous concentrations of flammable vapors or gases are likely to occur in the course of normal operations.

For protection against the hazards of flammable anesthetics used in hospital operating rooms, refer to the standards of the National Fire Protection Association on the subject.

b. Class 1, Division 2, Locations (1) in which flammable volatile liquids or flammable gases are handled, processed or used, but in which the hazardous liquids, vapors, or gases will normally be confined within closed containers or closed systems from which they can escape only in case of accidental rupture or breakdown of such containers or systems, or in case of abnormal operation of equipment, (2) in which hazardous concentrations of gases or vapors are normally prevented by positive mechanical ventilations, but which might become hazardous through failure or abnormal operation of the ventilating equipment, of (3) which are adjacent to Class 1, Division 1 locations, and to which hazardous concentrations of gases or vapors might occasionally be communicated.

This classification would usually include locations where flammable volatile liquids or flammable gases or vapors are used, but which, in the judgment of the code enforcing authority, would become hazardous only in case of an accident or of some unusual operating condition. The quantity of hazardous material that might escape in case of accident, the adequacy of ventilating equipment, the total area involved, and the record of the industry or business with respect to explosions or fires are all factors that should receive consideration in determining the classification and extent of each hazardous area.

Piping without valves, checks, motors, and similar devices would not ordinarily be deemed to introduce a hazardous condition even though used for hazardous liquids or gases. Locations used for the storage of hazardous liquids or of liquefied or compressed gases in sealed containers would not normally be considered hazardous unless subject to other hazardous conditions also. ★★★



Beats are complex low-frequency pressure waves that occur where high-frequency pulses from two or more compressors combine; and heavy equipment, like long pipe sections and large vessels, is readily excited by such waves. So when beats occur, it's trouble ahead for the big stuff. (Chart shows one complete cycle of beats in a compressor suction system.)

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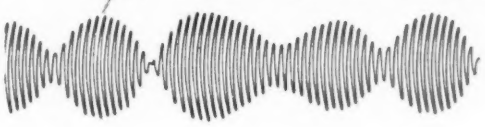

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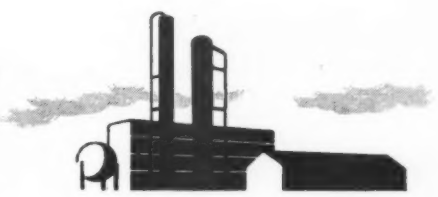

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Safe practices in using wire rope

By DON ATTAWAY, Arkansas Fuel Oil Company

EXCLUSIVE

IN 1847 a rope manufactory near Gateshead, England, constructed an iron wire rope nearly three miles long. It was called the stoutest rope ever made, and one of the earliest known wire ropes. Since that time man has discovered many industrial uses for wire rope such as hauling, hoisting, anchoring, and power transmission.

The extent or degree of accidents due to failure of wire rope is not completely known because records usually classify such mishaps under the category of handling or falling objects. A review of accidents in the oil and gas industry, however, shows a significant number of injuries directly caused by wire rope.

● **Construction.** One of the most common causes of wire rope failure is the use of incorrect size, construction, or grade.

The material most frequently used in wire rope manufacture is steel. Grades are known as cast, traction, mild plow, plow, or improved plow. Minimum strengths for the wire are specified in Federal Specification (RRR-571) and vary from 70,000 to 230,000 psi. It is not possible to procure more than 90 per cent of the aggregate strength of all the rope wires even in a test.

Wire rope is made in a wide variety of sizes with a different number of strands and number of wires to the strand, depending on the purpose of the rope. The greater the number of strands and wires per strand, the more flexible the rope.

Standard hoisting wire rope has six strands with 19 wires to the strand.

Special flexible hoisting wire rope has six strands with 37 wires each.

For extra flexible the number of strands is increased to eight and there are 19 wires to the strand.

These are hoisting ropes and are not to be confused with haulage or transmission rope. It is advisable for the working load of a hoisting rope not to exceed one-fifth of the breaking strength. Factors of safety in excess of five, varying up to eight or more, are often required for safe and economical operation.

Standard transmission wire rope is made with six strands having seven wires each. It is much stiffer than hoisting rope and has larger wires, which do not wear through quickly. It will not bend around small sheaves.

A third classification of wire rope is tiller or hand rope. It is made up of six ropes having six strands containing seven wires each. It is used for steering gear on boats and hand rope. Often it is galvanized and used for guy lines on smoke-stacks, derricks, and ship masts where exposure would corrode an ordinary wire rope. It is not suitable for hauling or hoisting.

The core of a wire rope, as a rule, is a fiber saturated with a lubricant. It adds little strength but acts as a cushion to preserve shape and lubricate the wires. Ropes subjected to high strain or pressure sometimes add an independent wire core center, which adds about 7½ per cent to the strength of the rope.

There are two general methods of laying up rope and very good reasons for this difference of direction between the strands and wires.

Regular lay is the pattern in which the wires are laid in the opposite direction to that of the strands in the rope, so that on the outside of the rope the wires lay approximately parallel to the rope axis. This pattern is standard for most applications and such rope is easier to handle during installation and less susceptible to kinking.

Lang lay rope is the pattern in which the wires and strands are laid in the same direction. This type has good flexibility and high resistance to abrasion and fatigue.

Wire ropes are made either *right* or *left* lay but in most cases it makes little difference which type is used. The right lay is usually called standard.

Preformed wire rope is made of wire permanently formed to the exact helical position assumed in the finished rope. During the fabrication of wires into an ordinary rope, the unresolved stresses cause a loss of resistance to binding fatigue. If wires are relieved of the tendency to fly away from the rope, the only factor determining resistance to bending fatigue is the natural resistance of the wires themselves. A preformed rope bends more easily and usually with less additional stress on the metal. It resists kinking or rotating and squirming in sheave or drum groove. It is easier to handle and resists whipping, spools better, has greater salvage value and longer life. In general preformed wire is safer to handle, although greater care must be taken in inspecting preformed wire for broken wires due to the fact the ends do not protrude from the rope.

● **Sheaves and drum.** Another important cause of wire rope failure is sheaves and drums that are improper, defective, or out of alignment.

The sheaves and drums for wire rope should be as large as possible depending upon the flexibility of the rope. If smaller drums and sheaves than those given in the RRR-571 specifications are used, the advice of the rope manufacturer should be obtained and followed.

Some rope users neglect to consider the bending stress that is produced around a sheave or drum, and consider only the load the rope is required to handle. This is a serious mistake as this condition affects the life of the rope as well as its safety.

The groove diameter of a sheave or drum should always be greater than the diameter of the rope and smooth to prevent cutting of the wires.

Winding two or more layers on a drum should be avoided because the rope will mash or jam and its life will be shortened. Where practical, the drum should be of diameter and length to take all the rope in a single layer. The added cost of such a drum will more than pay for itself in longer rope life and safety.

When two or more layers of rope are wound on a drum, it is important that the last groove should rise above the others so that the rope will rise without shock or strain to the second layer.

Alignment prevents undue wear. Ordinarily the lead sheave should be lined up with the center of the drum or with that center portion on which the rope is wound. Sufficient space should be left between the sheave and drum to avoid a sharp angle in the rope. A 2-deg angle is satisfactory with a grooved drum and single rope layer.

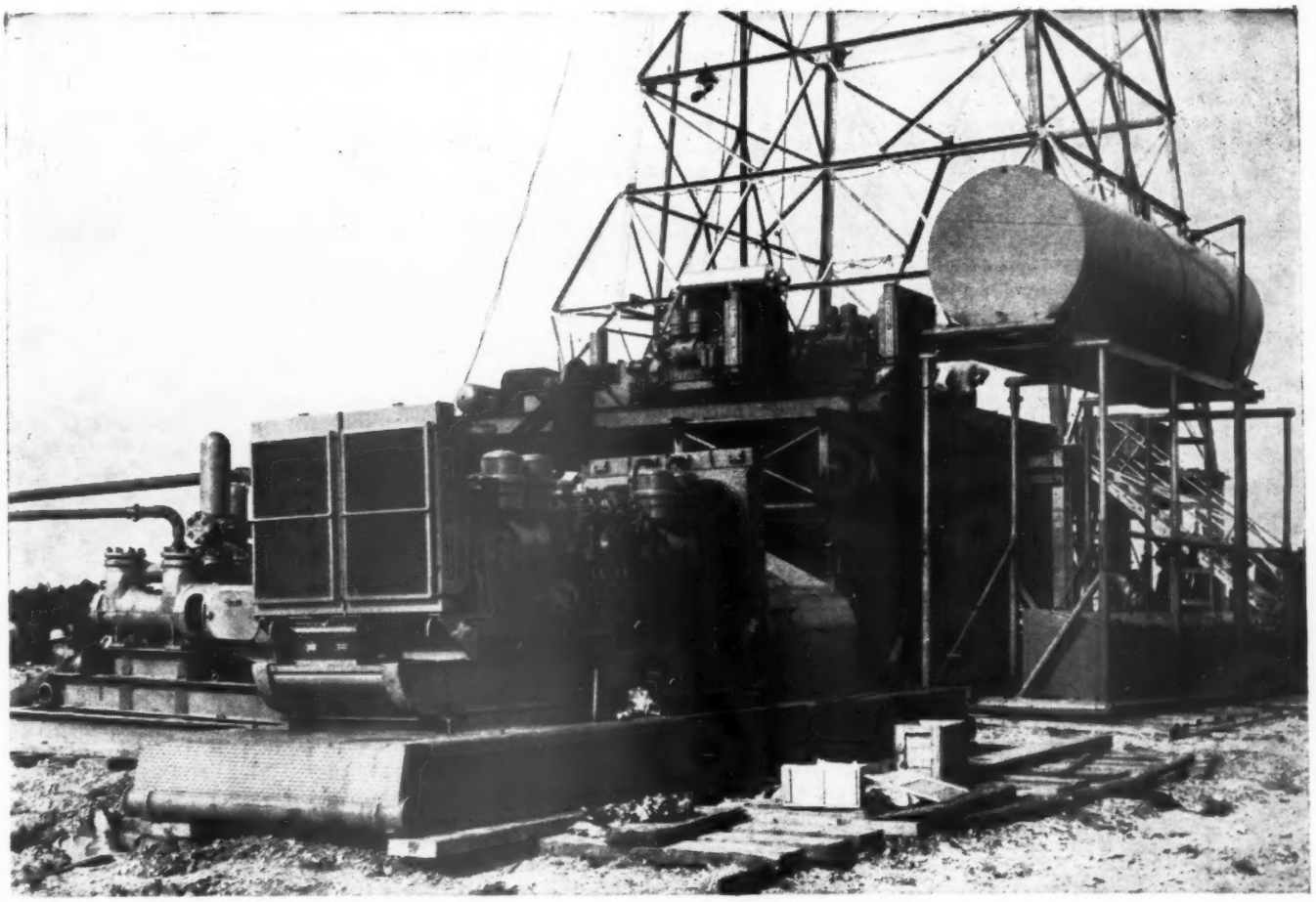
If sheaves become worn, new rope will not work properly and may be badly damaged. Steel inserts should be used in cast-steel or cut-iron sheaves if they wear unduly fast.

The fastest way to wear out rope is reverse bending, which means bending rope first in one direction and then in the opposite way over a sheave or drum. It is cheaper and safer to go to the expense of changing the machinery than to permit reverse bending.

● **Attachments and connections.** There are several ways to fit wire rope ends for connection or attachment. Thimbles, clamps, wedge and babbitt sockets and swedges, are a few. Every wire rope fastening should be examined at frequent intervals. Refastening is recommended at certain intervals. A section of the rope 4 to 10 ft above the socket or clip should be cut off. This removes the portion most likely to fail.

Thimbles should always be used where rope is looped or where a short bend is necessary.

Socketed connections are not always dependable. Poor workmanship is often concealed and the socket cannot be readily inspected. If the rope is held rigidly in the socket, a fatigue effect is



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produced just above the socket by the load imposed.

The wedge socket is quite reliable. It is a device composed of a tapered hollow shell to fit the rope and a grooved wedge. The end of the rope is first put through the small end of the shell and a loop formed. The wedge is inserted and a pull draws the whole loop and wedge down into the shell, wedging it securely.

Swedged attachments are more or less a steel sleeve fitted over the unseized end of the rope and forced firmly down upon the strands gripping them for the entire length of the sleeve. This connection is not safe for the regular six strand rope having a hemp center.

The cable clamp or clip connection is used more frequently than any other rope fastener. They may slip and crush the rope if too much pressure is used in tightening them, but they are easily and quickly applied and can be readily inspected. The number of clips is determined by the size of the rope and their use is not recommended on rope sizes over 1¼ in. Clips should always be installed so that the U-bolt is on top of the short end of the rope. Never stagger the clips.

Another type of fastener is the three-bolt clamp. Its holding power depends upon friction between the rope and the clamp. The better designs have corrugated grooves.

● **Handling.** Workers should use heavy or leather palm gloves when handling rope as broken wire ends can produce painful and serious puncture wounds. Wire rope should be handled carefully to avoid kinks and twists. Kinks are loops that have been "pulled through." The wires are bent and the rope usually damaged beyond repair. If the kink has not been pulled through, the rope may be straightened and used.

When wire rope is unwound from a reel there are three correct methods:

(1) Mount the reel on a shaft that is fastened in a fixed horizontal position. Pull the rope end from the bottom so that the rope unspools.

(2) Mount the reel on a turntable. Be careful to keep tension on the rope or a loop may drop below the reel and cause a kink.

(3) The end of the rope may be securely held and the reel rolled along the ground or floor.

Wire rope is often coiled and in unrolling a corkscrew effect is produced that results in kinks. To correctly uncoil wire rope, the outer end should be released and the coil rolled along the ground or floor like a hoop.

● **Seizing.** The ends of wire rope should always be seized to prevent unlaying, for when this occurs the rope becomes useless. Annealed wire should be wound tightly in a close helix around the rope.

Before cutting wire rope, it is necessary to place at least three sets of seizings on each side of the cut.

● **Lubrication.** All wire ropes, whether used for outside or inside work, should be treated at regular intervals with a lubricant to keep them pliable and to prevent rust. Pound for pound, wire rope probably has more bearing surface inside the rope than any other piece of equipment, so the importance and safety value of lubrication is obvious.

The lubrication compounds supplied by manufacturers and dealers are best, but engine oil SAE 10 below 32 F, and engine oil SAE 30 above 32 F, meet most wire rope requirements.

Lubricants must be free from acid, alkali, or corrosive elements and have good penetrating and adhesive qualities. In addition, they should not cake, gum, or ball-up if contaminated with dirt or metal particles.

Lubricant may be applied with a brush if no other method is available. It should be spread on slowly, carefully, and frequently because it is difficult to get complete coverage and penetration.

A more effective method is a simple three-sheave trough that can be firmly fixed near the drum or reel and the rope run through the lubricant no faster than 30 ft per min. Idle ropes are most susceptible to rust and it is particularly important to see that they are well lubricated when not in service.

The East Texas oil field, largest field in the world, has produced since its discovery in 1930 a total of 2,500,000,000 (billion) barrels of crude oil. This is about one-half what the field is expected to yield.—*The Petroleum Data Book*, Dallas, Texas.

☆ ☆ ☆

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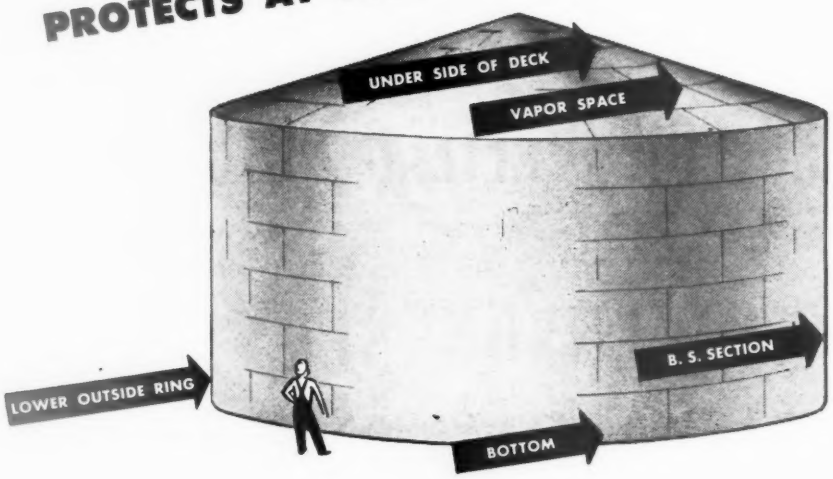

Natascoating tankage provides positive protection because Natasco protective coatings are insoluble in petroleum products, are resistant to hydrochloric acid, sulphuric acid and hydrogen sulphide, have high dielectric strength and are sufficiently elastic to withstand tank expansion and contraction. For full particulars on Natasco products and contract service, get in touch with

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DEPENDABILITY

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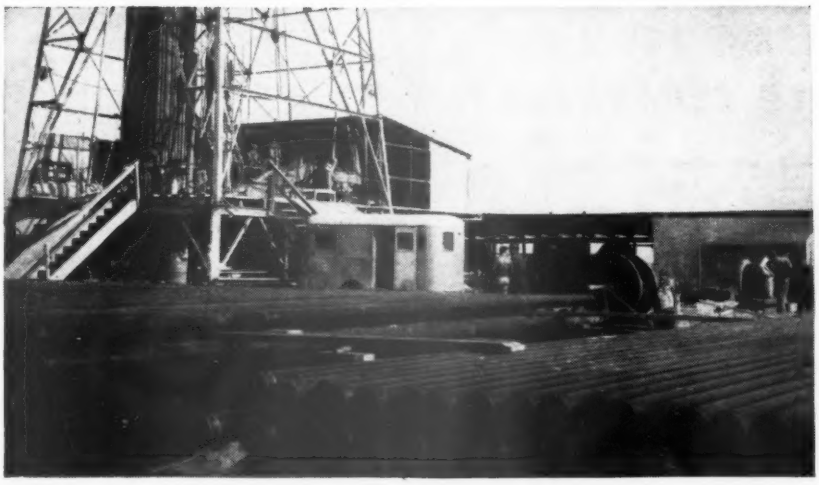

IN THE FIELD, LOUISIANA: Running a 10,000 ft. string of 8⅝-inch S-80 SMITHway Casing.

IN THE A. O. SMITH PIPE MILL: Welded casing, developed by A. O. Smith research, starts with rolled stock. This permits close inspection of both surfaces before fabrication.

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A regular lubrication program will insure full service from wire rope.

● **Dangerous wire rope.** Sometimes wire ropes are discarded because the "stretch" is gone. This is nothing more than the settling into place of the strands and the rope is still good, provided the wires are not broken. When a new rope is put into service and there is an equalization of stresses, some wires frequently break. This does not mean the rope is wearing out. The breaking of wires in a rope that has seen considerable service, however, does indicate that the useful life of the rope is ended. Abrasion, overstrain, binding, or rusting may cause this.

There is no definite rules as to when a rope is dangerous. This is one of the unfortunate factors in wire rope safety. The following suggestions are for general use only:

(1) If a rope is used for hoisting material only and there are no broken wires, a rope may be used until it is about 65 per cent of its original diameter.

(2) If 10 per cent of the wires in a lay are broken, or when adjacent broken wires in that strand exceed 20 per cent of the wires, the rope should be replaced.

(3) If a rope is used for hoisting persons it should be replaced when in the judgment of a qualified inspector its strength is impaired and in any event when the thickness is one-half the original diameter even though there are no broken wires.

TABLE 1. Recommended tread diameters for wire rope sheaves and drums.

Rope construction, strands x wires	Size recommended	Minimum size
6 x 7	72 times rope diam.	42 times rope diam.
6 x 19	45 times rope diam.	30 times rope diam.
6 x 37	27 times rope diam.	18 times rope diam.
8 x 19	31 times rope diam.	21 times rope diam.

TABLE 2. Intervals for refastening rope.

Expected life of rope, months	Maximum time between refastenings, months	Expected life of rope, months	Maximum time between refastenings, months
6	1	21	3½
8	1½	24	4
10	2	27	4
12	2	30	4
18	3	36	4

TABLE 3. Number and spacing of Crosby clips.

Rope diameter, in.	Number of clips	Inches between clips	Efficiency per cent
¾	5	4½	77.4
⅞	5	5¼	79.1
1	5	6	77.9
1⅛	5	7	80.0
1¼	6	8	82.2

● **Inspection.** Wire rope should be inspected at frequent and regular intervals by a qualified person and a written record kept of each inspection. Any defects or hazards should be corrected at once.

The essential points of the inspection should be:

(1) Be sure rope is correct in size, construction, and material for the purpose used.

(2) Check for evidence of corrosion, wear, and kinks.

(3) Examine attachments and connections.

(4) Inspect for broken wires.

(5) Check for proper lubrication.

(6) Examine sheaves and drum for size, design, wear, and alignment.

(7) Look for signs of improper use of rope such as overloading or reverse bends.

● **General.** This article cannot cover all the factors related to safety in using wire rope and is intended only as a guide. The degree to which mishaps can be avoided depends largely upon the supervisor or foreman in charge of operations where wire rope is used. It is his duty to train and instruct men in the safe practices necessary to wire rope operations.

In general, wire rope demands care. It cannot be dragged over obstacles, in dirt and grit, or exposed to heat, moisture, and fumes without damage or deterioration.

● **References:**

1. National Safety Council—Safe Practice Pamphlet No. 26.
2. Industrial Data Sheet D-Gen. 7.

★ ★ ★

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HOW FAR DOWN DO YOU HAVE TO GO TO BE SAFE FROM A THOMPSON SHALE SEPARATOR?

Mud flow from the deepest wells, the largest mud pumps is handled with ease by the Thompson "DWF" Shale Separator. Shale and abrasives don't have a chance to go back into the well and damage expensive drilling equipment. Increased profits show up on the books every time when abrasives are thrown out. *Another Thompson feature* that makes money for drillers: attached SAMPLE MACHINE—standard on all models—provides accurate foot-by-foot samples of cuttings. Thompson Separators are available in three sizes, each self motivating and designed to give utmost efficiency for its capacity.

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(1) Portable potentiometer

A new portable potentiometer for precise measurements of low voltages has been announced by the Meter and Instrument Division of the General Electric Company. The potentiometer is designed for checking temperature-measurement instruments and for the testing of rotating machines, ovens, furnaces, oil-burners, steam-driven equipment, and air-conditioning units. This new potentiometer was designed originally for measuring the low voltages of thermocouple outputs in testing steam turbines manufactured at G.E.

The equipment of the potentiometer, which is contained in a durable, fabric-covered luggage case, includes the galvanometer, standard cell, working batteries, and rheostats for adjusting the current through the potentiometer circuit.

The galvanometer, which is not built in, is provided with a built-in transformer so the galvanometer lamp may be operated from 115-volt, a-c supply lines, but if field conditions dictate, the transformers may be readily disconnected and the lamp operated from four No. 6 dry cells. In addition, a convenient system of keys is provided to enable readings to be taken rapidly, and all contacts are enclosed to prevent wear due to dust and dirt conditions.

This potentiometer has two ranges, 0-60 and 0-6 mv.

(2) Drilling rig

The National Supply Company announces what it believes to be the largest diesel-powered drilling rig in the world for drilling oil wells, the new Ideal Type 160 rig, with Ideal Gyrol fluid drive, as an addition to its line of Consolidated drilling rigs. This rig is conservatively rated for 16,000-ft drilling with 5-in. OD drill pipe.

The new rig now makes it possible to develop new oil reserves at depths heretofore unexplored, it is asserted. Petroleum geologists predict that oil may be found at depths of 28,000 ft in some areas. In 1947 there were only 12 wells drilled to 15,000 ft or deeper.

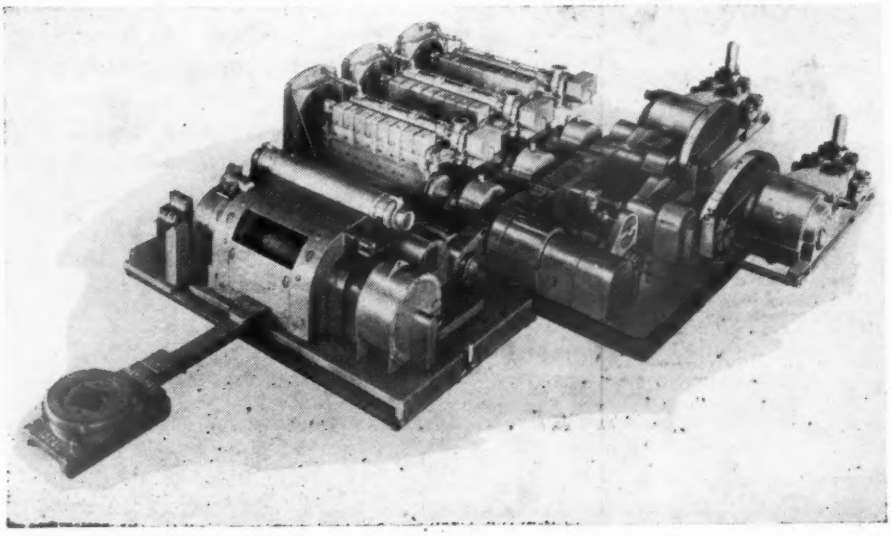
An operating feature of the Type 160 rig is the air-operated valves that control the principal operations of the rig. A feature of the drawworks is a spooling drum 36 in. in diam and 61¼ in. long, and grooved for 1½-in. wire line. Water-cooled brake rims for the drum are 62 in. in diam and 10⅜ in. wide. New, air-operated compound equalizing brakes are used, and 42-in. and 36-in. Ideal air-operated friction clutches are provided for the low and high drum drives, respectively. New Ideal air-operated friction type catheads have been incorporated as built-in equipment. Six hoisting speeds are provided through the three-speed, air-clutched transmission on the No. 1 engine sectional frame in combination with the high and low drum drive clutches.

The rotary machine, Ideal Type SHS-20½, is driven through a shaft drive from the drawworks also at six speeds.

An outstanding feature of this new rig is the Ideal Micromatic drilling control. It permits precision feeding of the drill bit.

Power for the Type 160 rig is supplied by a three-engine sectional drive group with built-in Gyrol fluid drives. The engines in this drive group are Superior PTDS-8 turbo-supercharged dual-fuel diesels developing a total of 2010 hp at 900 rpm. Supercharging boosts engine power about 50 per cent with only 15 per cent increase in weight and no increase in floor space. Dual-fuel operation permits conversion from oil to gas-oil or the reverse as simply as shifting gears in a modern motor car.

NEW EQUIPMENT



(3) Speed gears

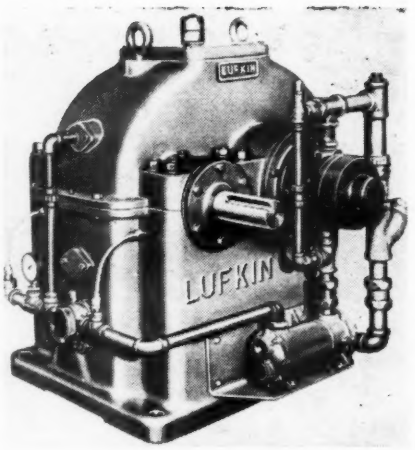
Announcing a new source of supply for users of industrial speed reducers and increasers, Lufkin Foundry and Machine Company recently issued a new gear catalog of information and data on a complete line of industrial herringbone gear reducers and increasers.

This catalog states that deliveries can be made promptly—within 10 weeks on most sizes and within 16 weeks on any size.

Long recognized as a manufacturer of quality and dependable gear units, Lufkin now offers not only a new and complete standard line of horizontal parallel-shaft Herringbone gear speed reducers and increasers, but builds also a standard gear unit assembly of this type for all power transmission jobs, deliveries for which can be made promptly, according to Lufkin officials.

Lufkin for the past 25 years has manufactured heavy duty speed reducers for oil field pumping service, and for many years has produced large quantities of special gear reducers and speed increasers for a variety of industries.

Lufkin gear assemblies are available in three standard types. The single reduction gear speed reducers are built in sizes ranging from 3 to 500 hp with any gear ratio up to 10:1. Double reduction gear reducers are built with a range of ratios from 10:1 up to 75:1 in sizes from 1 to 300 hp. High speed gear reducers and speed increasers are available in 33 sizes with any ratio up to 12:1. Loads up to several thousand horsepower can be transmitted; normal speed range is 3600 to 900 rpm. Pressure lubrication and cooling system are standard equipment.



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HUBER

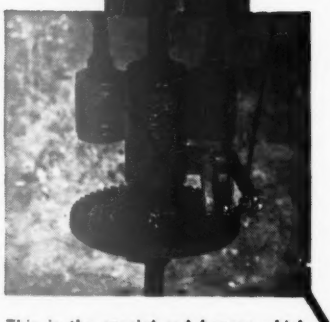
PARAFFIN SCRAPERS

If paraffin is accumulating in your wells, it will pay you to install Huber Scrapers on your Sucker Rods.

These steel blades, shrink-welded to the rods, clear the tubing wall by a fraction of an inch. Rotated by means of the special rotating rod hanger, they scrape the paraffin from the tubing wall as the sucker rods are rotated and reciprocated. Actually, they make the sucker rod a paraffin scraper.

Users report hundreds of dollars saved by eliminating paraffin removal costs with the installation of Huber Scrapers. Write for detailed records of savings made by the users of Huber Scrapers.

ORDER FROM YOUR SUPPLY STORE



This is the special rod hanger which rotates the rod string. The teeth on the turntable are engaged by two ratchet levers, which are operated by means of a flexible steel cable attached to the walking beam. With each reciprocation, the levers move the rod a fraction of a turn.

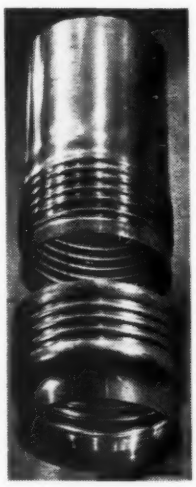
HUBER

J. M. HUBER CORPORATION

BOX 831 BORGER, TEXAS

(4) Shot hole casing

A special shot hole casing has been designed by Jones and Laughlin Steel Corporation to meet the essential requirements for speed and efficiency in seismograph operations.



With each charge of dynamite exploded, the bottom portion of the shot hole casing is destroyed. The remainder is recovered and used again.

Formerly second hand boiler tubes joined by couplings were used as shot hole casing. In addition to the inconvenience of stringing this casing, using the couplings, the joints were not always tight and the fine coupling threads were easily damaged, causing additional waste and lost time.

J & L's new development has but four heavy threads per inch and no couplings are necessary. The shot hole casing is made from 3-in. OD 16-gage Electric-weld tubing.

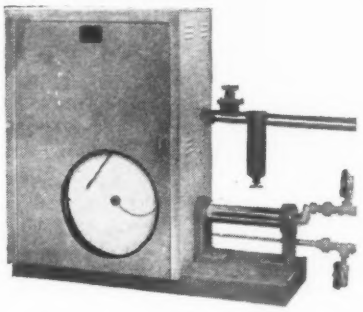
One end of each joint is expanded while the opposite end is slightly swaged and threads are cold rolled on each end. Since its development, it has grown to play an important part in the drilling of countless test holes.

(5) Gravity determination

J. W. Dunn, manager of the American Recording Chart Company, reports that a new Arcco recording controlling liquid gravitometer recently developed by his engineering and research staff serves a multiple of uses in the oil, gas, chemical, liquor, and other industries.

This new control type instrument incorporates the Arcco-Anubis recording liquid gravitometer, together with a popular make of control mechanism, as well as using several features covered by Phillips Petroleum Company patents.

The instrument controls and operates remotely through an air or hydraulic system the main plant motor valves, which control liquid flow. Control of finished products or blending of two or more finished products to any desired specific gravity is achieved.



The instrument may be pre-set to obtain any predetermined specific gravity result. In the transmission of crude and gasoline blends, the maintenance of specific gravity to a set flow is accomplished with the control instrument.

Another use is in fractionating. To obtain a pure overhead product where close range boiling point hydrocarbons are fractionated, the instrument serves as a protection against contamination of plant storage with off-specification products. The new Arcco recording controlling liquid gravitometer also is used to switch automatically different products to their proper storage tanks in instances where a transmission pipe line is used for two or more products.

(6) Generator sets

Stewart & Stevenson Services, Inc., has recently developed self-contained generator sets and utility units that are mounted on either two-wheel or four-wheel trailers. These can be rapidly moved to any point where electric or auxiliary power is needed. Originally developed for the road show business, which requires compact mobile generator set, these units are now being introduced to the drilling, pipe line, and producing divisions of the industry.

The units are designed to meet a wide variety of applications, and are powered with either GM diesel engines or Continental Red Seal gas-gasoline engines. Sizes range from 3 kw to 350 kw.

(7) Self-adjusting wrench

E-Zee Tool Manufacturing Company announces a new automatic self-adjusting and self-locking wrench with a perfect ratchet action. This wrench is available in two sizes—6 in. and 8 in. The 8-in. size will take nuts from 7/16 to 15/16 in., thus covering practically the entire range of five open end wrenches.

The jaws are made from chrome vanadium drop forged steel. The handle is made from alloy steel.

In cooperation with the Safety Campaign sponsored by the Insurance and Safety Committee of the American Association of Drilling Contractors, **CHIKSAN *All-Steel* Rotary Hose** is now being supplied with the specified identifying color ...YELLOW.

While new in Color, **CHIKSAN *All-Steel* Rotary Hose** provides the flexibility, dependability and economy which have been proved and accepted by the Petroleum Industry...and demonstrated by years of successful performance.

Write for your copy of the Complete CHIKSAN CATALOG or consult 1948 Composite Catalog for latest Information on Chiksan Swivel Joints and Fabricated Products.

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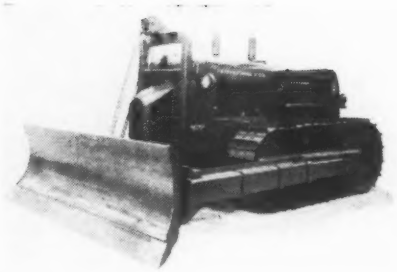
EXCLUSIVE EXPORT REPRESENTATIVE

BALL-BEARING SWIVEL JOINTS FOR ALL PURPOSES

(8) Tractor equipment

Now in production is a complete line of cable-controlled tractor equipment—including bullgrader, bulldozer, scraper, and ripper—especially designed by Bucyrus-Erie Company for the new International TD-24 crawler tractor.

The construction of every one of the machines is balanced to make the most of TD-24 power with minimum stress on tractor or attachment. High-test steel castings, poured in Bucyrus-Erie's own foundry and tested in its metallurgical laboratory, are used in combination with weldments. Cable and sheaves are protected by steel guards. Cable reeving is uncomplicated, and sheaves are large, mounted on roller bearings, and placed well out of the way of dirt. All parts are easily accessible for servicing.



Full visibility is one of the most important features of the bullgrader and bulldozer. With compact radiator guard and sheave support set close to the sides of the tractor and the upper bar close to the engine hood, the operator can see everything that the blade is doing. This results in greater speed and more accurate control, the manufacturer states.

(10) Nylon V-belt

A nylon-reinforced V-belt said to have twice the strength and four times the average life of conventional V-belts has been developed by United States Rubber Company. The belt contains a series of tough nylon cords covered with a special synthetic rubber compound capable of withstanding the deteriorating effects of heat and oil.

The belt is particularly recommended for power transmission on equipment subject to rough usage. In addition to high tensile strength it has great flexibility and a sufficient amount of elasticity to absorb shock, the company states.

The new belt will be distributed under the name of U. S. Royal Super Service V-Belt. The price will be about 40 per cent above belts of standard cotton cord construction. It will be made in fractional and multiple sizes.

(9) Reel-Rite winch

Costly, dangerous cable damage or breakage from loose and crossed coils is eliminated by a unique automatic spooling and tensioning device in the new Gar Wood Reel-Rite truck winch.

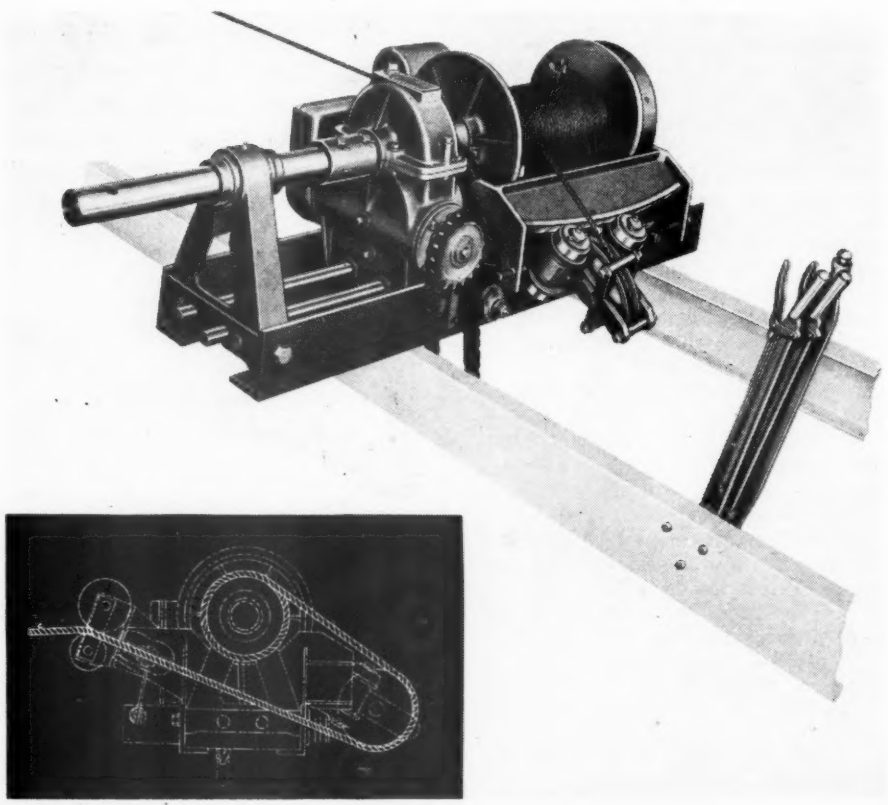
The spooling and tensioning device always spools smoothly and tightly. The tensioning sheaves apply proper tension even when the cable is slack. As a result, the cable is laid on in smooth, even, closely coiled layers. There is no bunching or piling up of coils—no crushing of rope, no cutting and breaking of strands due to uneven winding, the manufacturer states. The spooling unit is not mechanically linked to the winch drive so it automatically compensates for any change in rope diameter, stretch, speed, or wear.

Careless spooling is eliminated; hence, severe shock loads due to loose and crossed coils of cable are avoided.

This new winch has all the advantages of other Gar Wood winches, such as detachable back draft clutch, heat-treated alloy steel shafts, ball-bearing mounted worm, automatic safety brake, and patented flexible suspension.

At the present time, the Reel-Rite winch is produced in only one model having a capacity of 20,000 lb; however, additional models will be available in the very near future with ratings from 15,000 to 30,000 lb.

Top—Reel-Rite truck winch. Insert—Reeving diagram.



Jensens-

designed as you would build them

Take a good look at the next Jensen pumping unit you see. Notice in particular that it has the engineer's "flavor"—no fancy frills, no unnecessary parts—all pumping unit, built to do a job with the least amount of attention and expense. In a word, designed as you would build it.

Should you be one of the many unfortunate who doesn't have the opportunity to see Jensens at work in the field, write to Coffeyville for literature. Seeing details and specifications is almost as good as a field trip.

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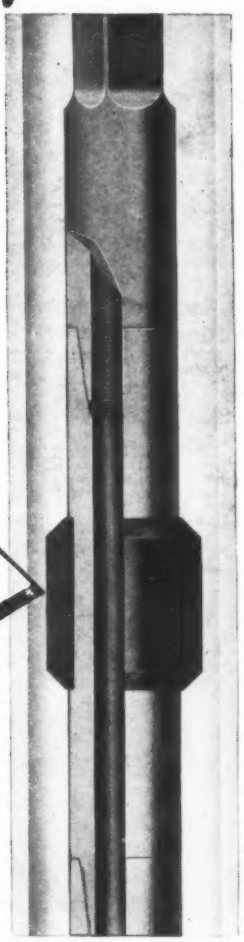
Save your Surface Casing from Kelly wear ...

WITH A...
PATTERSON - BALLAGH
KELLY SUB STABILIZER



That all-important top joint of casing stays after the drilling contractor leaves the location. There is no need for it to be almost worn through from the beating the kelly gives it. Protect your surface casing with a Patterson-Ballagh Kelly Sub Stabilizer installed on a saver sub.

Typical reasons for kelly wobble are the rotary table not being centered immediately over the casing, the crown block and traveling block not lining up with the hole, and a slight kink in the kelly. With the kelly 20' down, a slight amount of wobble will cause a corner of the "grief stem" to contact the side of casing and wear it through in a short time.

With a 4¼" square kelly hanging in 9⅝" casing, as shown in the illustration on the right, the distance between the side of the casing and the corner of the "grief stem" is 1²¹⁄₃₂". This is a small amount of clearance when you consider the number of causes that may make the kelly wobble. The cross section shown has a 4¼" Kelly Sub, 6" O.D., grooved to 5½", with a Patterson-Ballagh Stabilizer, Code: FLAX, installed. The 7¹³⁄₁₆" diameter of this Stabilizer gives ample protection against wear and does not interfere with mud circulation. Install a Patterson-Ballagh Kelly Sub Stabilizer on your saver sub *today* and save your surface casing.

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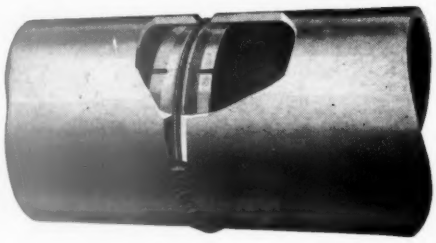
Many Engineers know the saving and added safety which WEDGE Chill Rings with the patented SPLIT Feature offer. It is no longer necessary to use heavy pipe. WEDGE Chill Rings REINFORCE the joints, giving greater strength where it is needed most, thus permitting use of economical



thin wall pipe. In case of shock, strain or vibration the pipe will fail before the joints. WEDGE Chill Rings give 100% weld penetration of entire joint circumference. Their positive pipe positioning feature speeds up pipe alignment. We can furnish different designs in all sizes. It will pay you to investigate because of the economy offered only by WEDGE Chill Rings.

Write for Information

WEDGE PROTECTORS, INC.
3977 Jennings Road, Cleveland 9, Ohio

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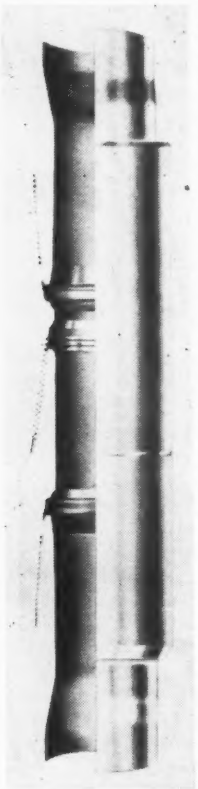
(11) Double-seal pipe

Spang shrink thread drill pipe and tool joints with a double seal are announced by the Spang-Chalfant Division of the National Supply Company. Although the original design, with only an internal seal at the small end of the pipe thread, proved highly successful, the improved design, with an additional seal at the large end of the pipe thread, has certain advantages, principally the elimination of possible entry of drilling fluids from the outside, it is asserted.



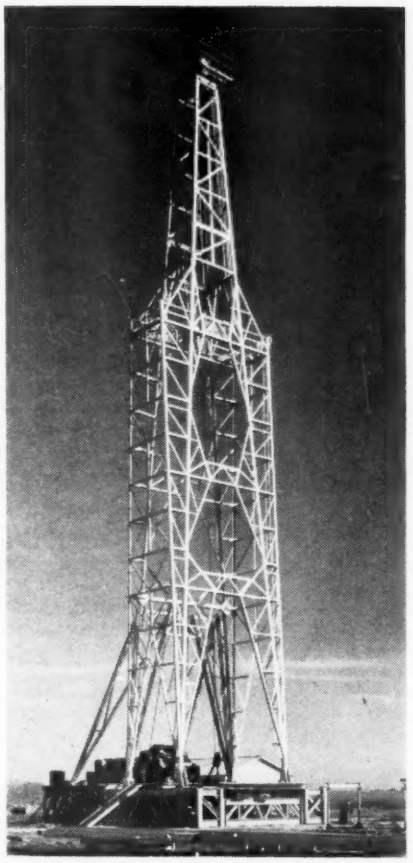
The new external seal is a metal-to-metal contact between mating conical surfaces of the drill pipe and tool joint at the large end of the pipe thread. After the tool joint is heated to approximately 800 F and screwed on the pipe by hand, natural shrinkage forces these surfaces into contact at a high bearing pressure.

Spang double-seal shrink thread drill pipe and tool joints retain all the features of the single seal joint. There can be no last engaged thread failure arising from the runout threads because the root diameter of the pipe thread at the runout is equal to or greater than the diameter of the pipe adjoining it. Every pipe thread is engaged and its root is supported by a tool joint crest. The notch effect at the bottom of the conventional "V-type" threads is avoided. Also, the broad flat crested threads develop exceptionally high resistance to creepage.

(12) Portable mast

Emsco Derrick and Equipment Company announces the development of a new bulge type portable mast for deep drilling. A special feature of this mast, designated 18P, is that it may be equipped with either one or two bulges. The double bulge construction is especially advantageous when the mast is barge-mounted for workover operations on water locations. It permits the simultaneous racking of both drill pipe and tubing.

The 136-ft height and the crown block capacity of 800,000 lb make the 18P portable mast comparable to standard API derricks that have been used for drilling to depths in excess of 15,000 ft. The Emsco bulge type portable mast permits adequate supporting of all four legs by exterior bracing thereby eliminating the need for interior stiffening members.

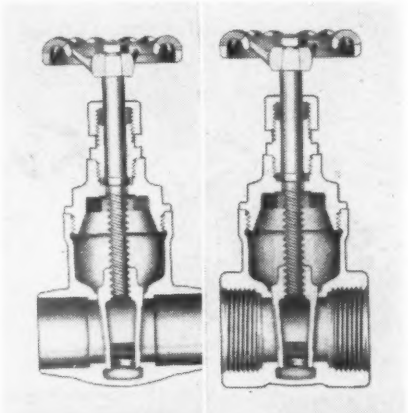


Another outstanding feature of the new mast is the amount of racking space available. One hundred ninety-two stands of 4½-in OD drill pipe may be racked in a single bulge while holding the inside stands 5-ft from the center of the well.

(13) Brass gate valves

Crane Co. announces a new line of 100-psi brass gate valves. These valves are furnished in two types, the No. 410 screwed-end valve in sizes ¼ in. to 2 in., and the No. 1320 solder-joint valve in sizes ⅜ in. to 2 in. These are non-rising-stem valves and are intended to replace Crane No. 449½ and 1319, which are being discontinued.

The body design of the new valves is an innovation, incorporating features rarely found in low-pressure valves. The upper portion of the body is cylindrical in shape, similar to the design that has been used only in steel valves for the



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GAS - OIL RATIOS OUT OF LINE?

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THE MATERIAL THAT'S EASILY REMOVED*

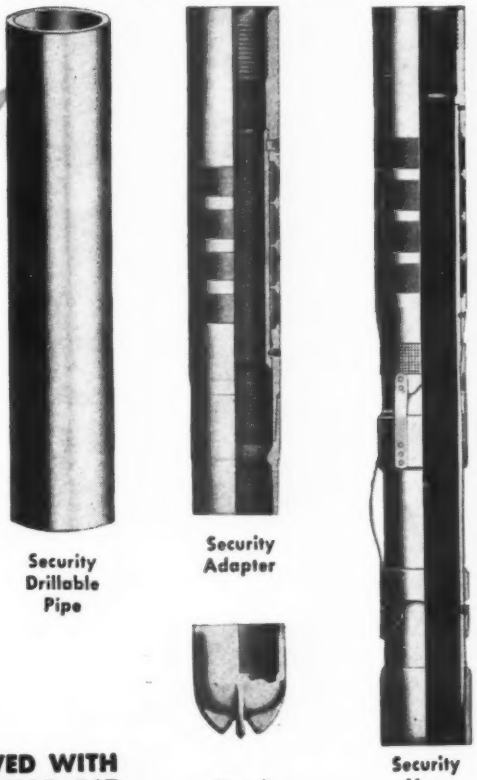
WHEN YOU are confronted with any one of the many problems which necessitate remedial work, rely on SECURALOY for safety and economy. SECURALOY can be completely removed with a *drilling bit* or *chemicals* when desired, yet its physical properties are capable of withstanding the most rigid oilfield requirements. The use of SECURALOY casing sections, liners, tubing, tail pipe, packers, hangers, adapters, formation tester bodies, etc., enables farsighted operators to economically recomplete their wells, obtain longer producing life and greater returns from their oilfield investment.

By standardizing on SECURALOY drillable pipe and accessories, you can guard against many of the risks that cause expensive fishing jobs or premature abandonment.

Over the past 10 years the outstanding success of SECURALOY has completely revolutionized long-established drilling and production methods. It has been used in thousands of wells representing an extremely wide variety of conditions. SECURALOY is constantly being used to solve problems arising from the development of new oilfield methods and techniques.

Probably the very SECURALOY installation you are wondering about for your well has already been successfully performed. At any rate it will pay you to consult our engineering department about the solution of your particular problem. SECURALOY assures your getting the most from your development dollar!

A LARGE VARIETY OF SECURALOY ACCESSORIES ARE AVAILABLE FOR ALL TYPES OF INSTALLATIONS.



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highest pressures. This design combines maximum strength with light weight. The cylindrical shape of the body, in addition to being ideal for resisting pressure, reinforces the seats against the wedging action of the disk. This safeguards against distortion of the body when the valve is being seated.

The ends of the solder-joint design are made to fit closely over hard copper tubing. The close fit enables the solder to flow into the joint by capillary action. The joint is soldered by what is known as "end feeding," the solder being fed into the joint from the outer end of the socket.

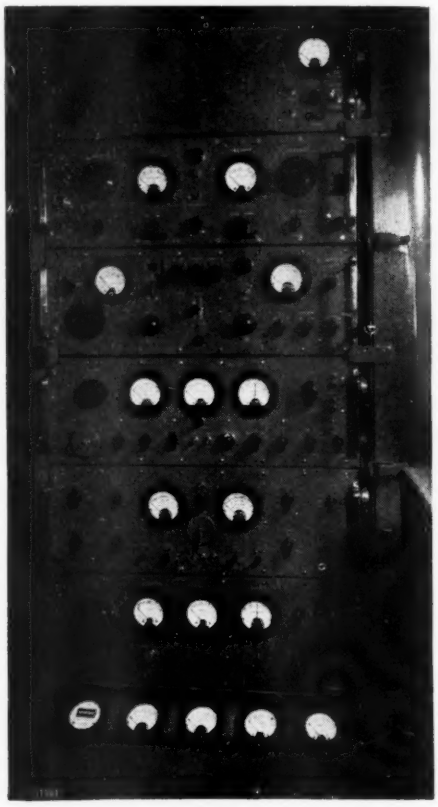
The disk is the one-piece wedge type and is guided by means of long guides that assure correct seating. Valve seats are cast as part of the body. The stuffing-box is packed with molded asbestos, and can be repacked while under pressure when the valve is wide open.

The screwed valves are recommended for use on low-pressure condensate lines, exhaust steam lines, and low-pressure process steam lines. They also are intended for use in water lines, steam and hot-water heating lines, gas lines and fuel-oil lines. The solder-joint valves are suitable for the same services, except that they are not recommended for gas or fuel oil because of the fire hazard involved in working with solder. Specific working recommendations allow the valves to be used with saturated steam at working pressures up to 100 psi and for water pressure up to 125 psi at 200 F. Precautions must be taken, for use at steam pressures and temperatures this high, to make up solder joints with high-melting-point solder.

(14) Well logging unit

The new Schlumberger well logging unit, in contrast with previous units, is equipped to record simultaneously four SP curves on one trip out of the hole. This record is available to the company representatives on location.

These new units contain permanent panels for all services. From top to bottom: (1) Open hole section logging; (2) gamma ray logging; (3) photoclinometer and dipmeter surveys; (4) gun perforating, side wall coring, and casing collar locator; (5) electric logging, and (6) induction logging.



(15) Centrifugal pump

The new Mission Manufacturing Company centrifugal pump operates on the Sherzer hydraulic principle. The outstanding feature of this pump is the concentric casing, which minimizes ex-

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Quality
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See Cummins Diesels
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SINCE 1919...PIONEER OF PROFITABLE POWER THROUGH HIGH SPEED DIESELS

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Power and *more power* . . . the kind you need for extra footage in any formation . . . the kind that makes possible fast round trips, more hole on every shift. This *plus-power* of the Series NH-600 (200 hp, max.) and NHS-600 Supercharged (275 hp, max.) Cummins *Dependable* Diesels results in extra footage, fast round trips . . . consistent, day-after-day delivery of rock-bottom, overall economy.

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CUMMINS ENGINE COMPANY, INC.
COLUMBUS, INDIANA

cessive turbulence and cavitation normally caused by the cut water in the conventional design. This reduces wear and results in sustained high capacity for the pump.

The pump is of the single stage, end-suction type with non-clogging fluid passages. It can easily handle slurries containing large solids and materials in suspension. The casing, impeller, and wear plate, which come in contact with the fluid pumped, are available in various types of corrosion-resistant alloys .

(16) Engine starters

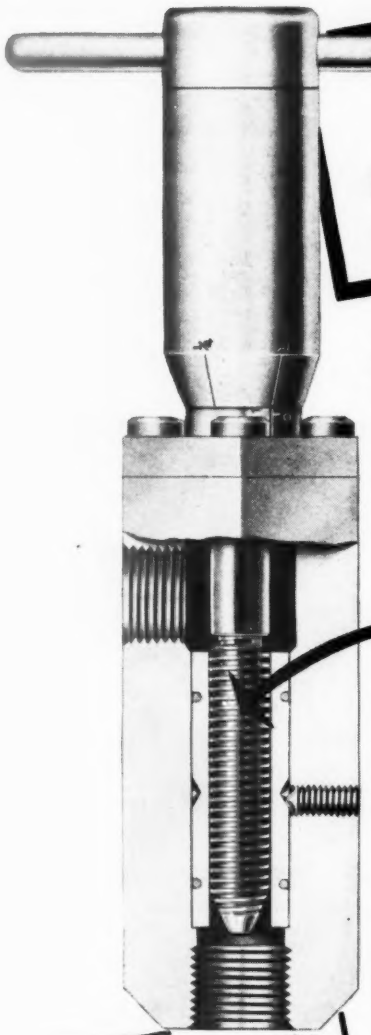
The new P & H engine starters of the Happy Company are showing exceptional performance in the starting of large fly-wheel engines, the manufacturer states. They are supplied as a complete unit and consist of an engine, V-belt drive, friction pulley, lever, base and belt guard. Installation is simple and inexpensive.

There are four models for engine sizes, 15 hp through 80 hp. Special units can be designed for engines of more than 80 hp.

P & H starters are always ready for immediate use—no waiting for air pressure to build up, no bad air mixtures to cause starting difficulties, the maker states. No piping, pressure gauges, or pop off valves are required. In short, P & H starters are efficient, safe, operate at low cost, and require limited space.

Here's something new in valves...

It's the
WILLIS
FLUID CONTROL VALVE
The only valve with a helical orifice



The Willis Fluid Control Valve is a completely new approach to precision, clog-free fluid control. Developed for hydraulically-actuated pumps, including deep well free pumps, the Willis Fluid Control Valve incorporates a positive helical orifice that remains the same in cross-sectional area at all flow rate settings—even as little as *10 B/D! Regardless of flow rate, there is always ample clearance through the helical orifice to pass foreign particles that would normally shut off or partially clog the annulus of a needle or other type fluid control valve.

Helical Orifice Principle

In fluid applications, a helical orifice is machined about the circumference of a stem to form a spiraling path for fluid passing through the valve. As the stem is withdrawn from a hardened and ground sleeve by rotation of a micro-adjusting assembly, the length of the helical path remaining in the sleeve is shortened to increase flow rate—as the stem is lowered into the sleeve, the helical fluid path is lengthened to decrease flow rate.

B/D flow rate is dependent upon 3 factors: (1) cross-sectional area of the helical orifice; (2) length of the helical path "seating" within the sleeve; (3) fluid pressure differential.

*Willis Fluid Control Valve Small Capacity Stem (10 B/D to 60 B/D)—4 sizes of interchangeable stems ranging up to 400 B/D control capacity are available.

IT'S NEW! . . . . IT'S FOOLPROOF!

Put the "Helical Orifice" principle to work on your fluid control problem—Write for 4-page folder!

WILLIS OIL TOOL COMPANY

Long Beach, California
3440 Pine Avenue

Houston, Texas
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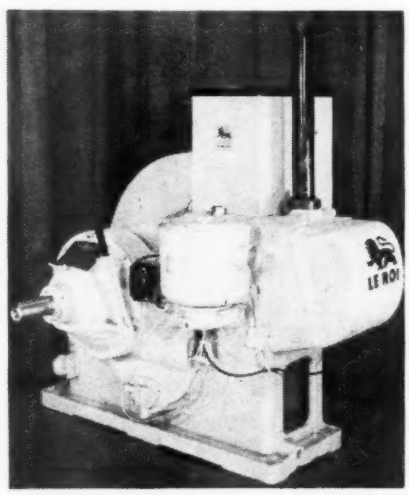
Mid-Continent Representative: SPECIALTY SALES AND SERVICE, INC., P.O. BOX 485, Tulsa, Okla.

(17) Pumping engine

A new single-cylinder oil well pumping engine, the A288, has been announced by Le Roi Company. With its 7¼-in. bore and 7-in. stroke and speed range from 360 to 720 rpm, the A288 has an API horsepower rating of 8 to above 17, maximum 13 to 26.

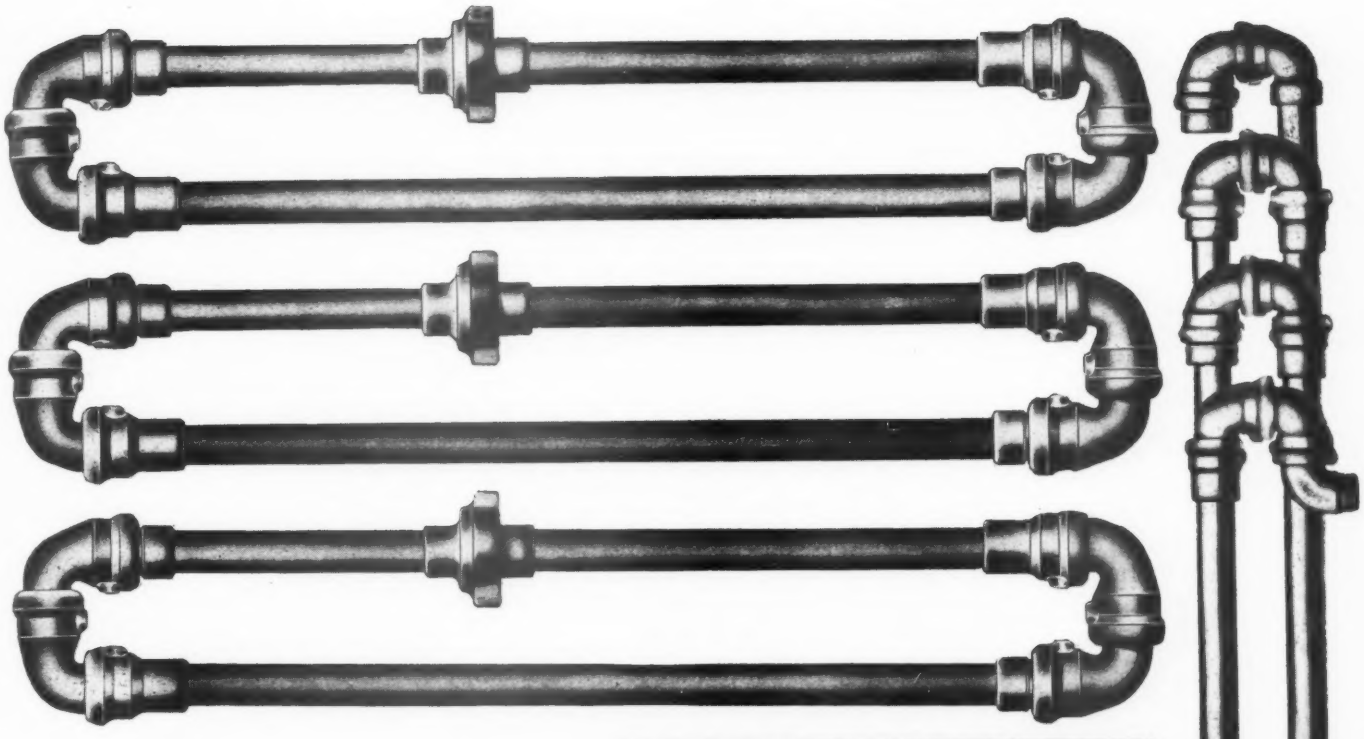
It is entirely self-contained and fully enclosed to fit to pumping jacks without the need for housing or guard rails. It

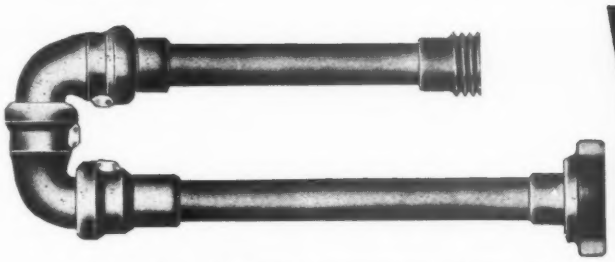


runs in all kinds of weather with little or no attention or servicing, it is asserted.

Liquid cooled, its cooling system is a patented, closed "Vaporizing-Condensing" cycle with air flow through condenser core created by an integral centrifugal fan that also serves as the flywheel.

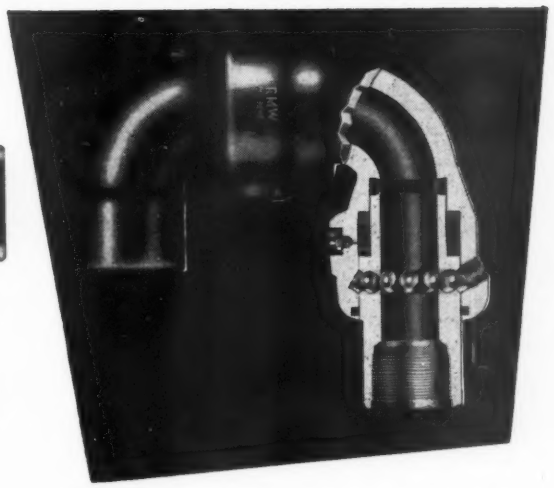
Every moving part is lubricated from the crankcase oil supply by a full pressure, gear-type pump-filtering system is combination full-flow bypass with a replaceable element.





Roofe All-Steel Cementing Hose illustrated here is furnished with either 14 or 21 swivel movements.

Roofe All-Steel Drilling Hose is furnished with swivels providing 17 swivel movements.



Roofe All-Steel Drilling Hose and Cementing Hose are available for 5,000 lb. and 10,000 lb. pressures

Whichever meets your needs . . . for medium or high pressure service . . . you will find that Roofe All-Steel Cementing and All-Steel Rotary Hose is the most dependable, the easiest swiveling hose available.

The exclusive bearing and packing construction in Roofe Swivel Joints is designed so that cement, mud, caustic mud additives and other abrasives can not reach the bearings. This means longer joint . . . and hose life . . . with less maintenance, less lost time. Specify Roofe Swivel Joints. They are available now.

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trade literature

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(18) Slush pump

Bulletin No. 322, 16 pages, describes and profusely illustrates the Ideal Type C-150 duplex power slush pump, which has a 6¾-in. bore and 12-in. stroke, and a rated output of 150 hp. It will discharge 500 gpm at a pressure of 555 psi or, with a 5-in. diam liner will discharge 265 gpm at 1045 psi. This pump is one of a series of six pumps ranging from 50 to 700-hp output.

The bulletin contains descriptions and illustrations of all main members of the power end and fluid end, including fluid valves and seats, liners, pistons and rods; lubrication, including a feature that prevents mud contamination of crankcase oil; specifications, performance chart, and drawings with principal dimensions. The bulletin is issued by The National Supply Company.

(19) Non-lubricated "Ball" valve

A 4-page bulletin graphically describes the new Kerosphere non-lubricated "Ball" valve recently announced by Kerotest Manufacturing Company, for high and medium pressure service in oil refining, petro-chemistry, food and chemical processing, and related services.

The Kerosphere is a completely new valve design that utilizes a spherical ball that absorbs the thrust of line pressures on vertical trunnions and is sealed by seats that remain in constant contact with the sphere. Full opening or closing is accomplished with a quarter turn. Uniformly easy operation under high pressure, without lubrication, is claimed since the pressure against the spherical ball is absorbed by the trunnions. The seats provide constant seal, which also eliminates sediment collection that could cause abrasion or galling. A burnishing action is also claimed that constantly improves the ball and seat surfaces. The Kerosphere Ball valve operates with temperatures up to 450 F, pressures up to 4000 psi, and is adaptable for many corrosive services. All working parts are 12-14 chrome heat treated stainless steel, and conform with ASA specification B 16e.

(20) Emergency power

How standby electric power plants serve hospitals, theatres, hatcheries, homes, manufacturing plants, and in many other places is described and illustrated in *Power Points*, a magazine published by D. W. Onan & Sons, Inc. The entire issue, Volume 4, Number 1, is devoted to the problem of electric power emergencies. The magazine describes how standby protection, delivered by Onan emergency electric plants, provide security against losses caused by electric power failures. Persons interested in a practical solution to the ever-present problem of electric power shortages and breakdowns will be interested in this magazine.

(21) Steam-detergent cleaning

A thorough-going review of the theory and applications of industrial steam-detergent cleaning is presented in an interesting, illustrated Service Report published by Oakite Products, Inc. The report defines steam-detergent cleaning as the simultaneous application of three different actions: (1) The physical action of steam pressure and hot water working their way through successive layers of grease and dirt; (2) the dissolving action of heat on oil, grease and other deposits, and (3) the chemical action of the detergent in wetting, penetrating, and emulsifying surfaces deposits. Long experience in industrial cleaning work, the Service Report states, has indicated that this simultaneously applied combination of efficiency factors provides the ultimate in cleaning, speed and thoroughness. Typical instances where the application of steam-detergent cleaning has made possible time and coat-savings in the petroleum industry are reported to be: Cleaning pump and drilling equipment, rotary table, mud hogs, twin engines, crown blocks, swivels, other large equipment, before inspection and repair; paint-stripping diesel and gas engines; removing slime from coils and evaporative condensers; cleaning oil storage tanks and pipe lines; stripping paint from drilling rigs, etc.

In addition to listing many tasks for which steam-detergent cleaning has demonstrated exceptional effectiveness, the Service Report supplies much interesting data on types of steam-cleaning equipment available, on specific detergents designed for use with such equipment, on the preparation of efficient working solutions, and on the use of steam-cleaning units for stripping oil-base paint, lacquer, enamel, and other organic finishes from various surfaces.

(22) Pumping equipment; reduction gears

Oil Well Supply Company has issued Bulletin 8C-1047 entitled "'Oilwell' Pumping Units, Reduction Gears, and Pumping Jacks." These several types of equipment are fully described and illustrated with photographs and diagrams.

(23) Morflex flexible couplings

Morse Chain Company has a new 32-page catalog ready for distribution on request. The catalog is devoted to the Morse Morflex flexible coupling line. Covered in the publication are such points as the development of couplings, their construction and working principle.

Available through distributors of Morse mechanical power transmission products, Morflex couplings are made in a variety of capacities ranging from the "Junior" Morflex with 0.06 hp rating per 100 rpm, to Double Morflex couplings with a 13.80 hp rating per 100 rpm.

On such installations as oil-well equipment, stone crushers, and crane hoists Morse has developed a Morflex radial coupling to absorb heavy torque loads, shock and high-frequency load reversals.

(24) Coal-pulverizing and burning

Coal-pulverizing and burning equipment for industrial furnaces and for steam generation is discussed in a bulletin issued by The Babcock and Wilcox Company. The development and application of such equipment is described and the text is illustrated with diagrams and photographs.

Adapted from a report to the Federal Power Commission by D. V. Sherban of The Babcock and Wilcox Company, the bulletin analyzes the successful application of pulverized-coal firing in various types of industry.

(25) Special projects

What it takes in the way of personnel and equipment to develop new processes and machines is related in Issue No. 3, 1948 of the *Kellogram*, published by The M. W. Kellogg Company, engineers of Jersey City and New York. The 8-page brochure describes for the first time the wartime and postwar activities of Kellogg's Special Projects Department in the government program to develop such tools of tomorrow as rockets and guided missiles for military use; high speed turbines for supersonic aircraft; new type fuels and high temperature alloys.

Seventeen photographs of some unusual test equipment—some of it to be found in no other laboratory—forcefully illustrate the article.

(26) Fire fighting folder

The General Pacific Corporation has prepared a special file folder headed "Fire Extinguishers" that is available without cost upon request.

Inside the two-color folder lists the classes of fires, the type extinguisher to be used for each class, and explains briefly and clearly the method of operating the various types of extinguishers. Pictures of General Quick Aid fire guards illustrate the chart. The outside of the folder illustrates and defines other types of General Quick Aid fire guards.

Of standard file size, this General Pacific folder provides a handy reference for fire prevention and valuable fire-fighting information.

(27) Adjustable threader

Beaver Pipe Tools is mailing out a bulletin on its new No. 77 Beaver adjustable threader. This tool is made especially for power drive use and uses the same high speed steel dies as in the company's pipe machines, according to the manufacturer.

M. O. JOHNSTON *Presents*

...THE FIRST BASIC DEPARTURE FROM CONVENTIONAL DRILLING EQUIPMENT IN THE HISTORY OF THE OIL INDUSTRY

This revolutionary development is so far reaching that it will change the plans of many oil men

BE SURE TO SEE THE JOHNSTON EXHIBIT AT THE OIL SHOW BOOTH 104-F

(28) Silica gel dehydrators

The Engineering Division of The Davison Chemical Corporation has issued a bulletin, No. 401, on silica gel dehydrators. The dehydrators are being used by industry to remove moisture from process gases such as hydrocarbons, inert gas, carbon dioxide, nitrogen, oxygen, hydrogen, and compressed air for process and air actuated instrument supply.

(29) Gas drilling engine

A new 16-page bulletin, No. 315-A, superseding Bulletin No. 315, describes and illustrates the Superior Type 6G-510 gas drilling engine of The National Supply Company. This six-cylinder engine, 8½-in. bore by 9-in. stroke, is rated at 300 hp at 900 rpm for continuous operation.

The bulletin describes the main components of the engine and illustrates construction features. It includes new pictures of the engine, which show various modifications of design and changes in accessories since bulletin No. 315 was issued. A new performance chart, covering speeds from 400 to 900 rpm, shows maximum torque, fuel consumption, and continuous, intermittent and maximum brake horsepower. Specifications and dimensional drawings are also included.

(30) Rolled sheet and plate

The advantages of using bronze rolled sheet and plate produced from centrifugally cast slabs of Ampco Metal Grade 8 are described in Bulletin 94 issued by Ampco Metal, Inc. This new bulletin, entitled, "Ampco Rolled Sheet and Plate," points out that centrifugally cast aluminum bronze results in a sheet that is sound, flaw-free, and uniform throughout. The sheet may be used as annealed in the production of fabricated material, or in unannealed form may be used in wear-resistant services for ways, slides, liners, etc. The new bulletin contains tables of physical properties, dimensions, weights, tolerances, and similar technical information. Of interest is a chart prepared from a report made by Battelle Memorial Institute showing physicals of Grade 8 annealed sheet at a wide range of temperatures.

(31) Materials handling

Illustrated catalog No. 1099, detailing the palletless material-handling applications and optional equipment of the Hyster Load-Grab, an attachment for the Hyster Models "20" and "40" lift trucks, has been published.

The Load-Grab is an hydraulic attachment with steel arms designed for the squeeze-carrying of bales, boxes, bundles, bags, barrels, or oil drums without pallets.

The profusely-illustrated catalog shows the Load-Grab in action in textile and oil industries and general warehouse. It further outlines major specifications and dimensions of the two models of the device.

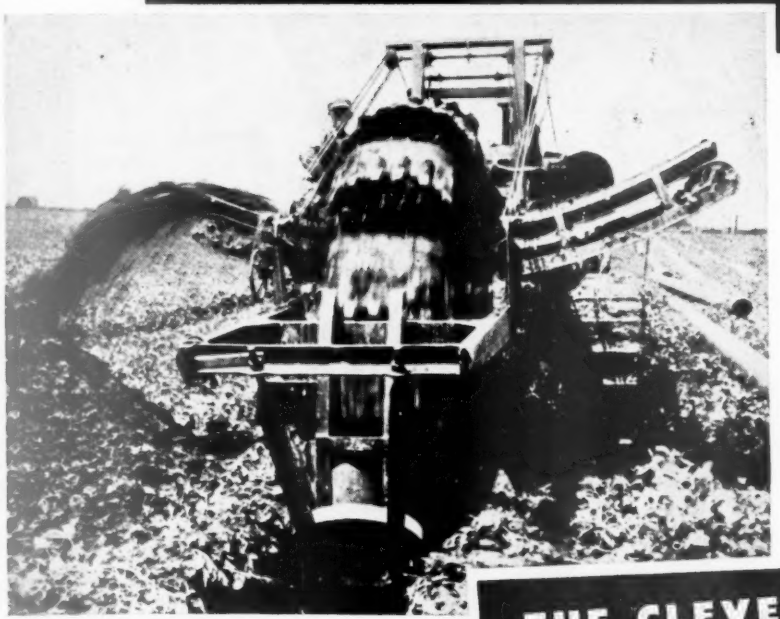
(32) Improved combustion safeguard

The Wheelco Flame-otrol, a combustion safeguard for gas and oil fired furnaces, ovens, boilers, kilns, and other heating equipment, has been enhanced by two new improvements designed to provide increased safety and equipment protection against explosion hazards. A "Safe Start Relay" is mounted on the chassis of the instrument to prevent operation in the event that any unsafe condition exists during start-up period. Even depressing the push-button of the manual reset will not put the system in operation until a safe condition is assured. The Wheelco Flame-eye, sensing unit for oil-fired equipment is now equipped with a "Blue Sensitive" Photo Cell, responsive only to "blue spectral" rays, which are a characteristic of oil flames. This new feature eliminates detrimental effects of red rays reflected from furnace walls or other extraneous sources.

(33) Industrial chromium plating

A revised catalog designed to provide helpful information for successful applications of industrial chromium plating is announced by the Chromium Corporation of America. The 36-page, profusely illustrated publication outlines the accomplishments of chromium plating, and describes performance that might be expected under known operating conditions. Supplementing the information, research facilties and technical advice are offered by the corporation in solving specific problems of wear and corrosion.

CLEVELANDS



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Drill pipe failures, inspection, and protection in the Permian Basin*

By W. H. CRENSHAW,[1] V. B. BOTTOMS,[2] C. N. WALLACE,[3] and C. R. O'DELL[4]

● **Abstract.** This paper discusses from a progress standpoint some of the steps taken by drilling operators in the Permian Basin during the last two years toward, reducing drill pipe failures. A summarization is given of the types of failures experienced and the steps being followed to prevent them. Two of the most important of these steps, inspection and protection, are discussed somewhat in detail inasmuch as both steps have seen a great deal of progress during the period covered.

The economics of both inspection and protection, i.e., protective coatings, are discussed, as well as methods and processes which have seen field testing.

The authors conclude that a large amount of progress has been made in recent years toward reducing drill pipe failures and they attribute this progress to better operating techniques developed through research.

● **Introduction.** This paper deals with the progress made during the last two years in the reduction of drill pipe failures in the Permian Basin.

● **Drill pipe failures.** During the last several years numerous papers have been written concerning drill pipe failures and their causes. Therefore, it is not felt necessary to the objective of this paper to enlarge on the subject. It is believed, however, that a brief resume of the various types of failures will serve to refresh the reader's memory as he follows the information that is given.

A. Summary of types of failure and cause.

1. Abrasive wear (undergauge).
   Occurs: Most frequently in the center of the joint over an area of approximately 8 ft.
   Cause: Running of crooked pipe, and running pipe in severe compression causing severe bending reversals with resulting whipping in the hole.
2. Fatigue failure (See Figs. 6, 8, 9, and 11).
   Occurs: In the lighter drilling areas, the cracks occur within 4 or 5 ft of the end of the joint. In the hard rock drilling areas, primarily West Texas and New Mexico, the cracks were found to occur at any area along the entire length of the pipe.
   Cause: Fatigue defects are classed as those occurring during the service life to which the pipe is subjected, and are divided into three groups:
   1. Those occurring from pure fatigue, i.e., where the joint has exceeded the stress load for which it was designed.
   2. Those cracks occurring from notch fatigue, wherein the crack develops in less than the maximum number of stress reversals for which the pipe was designed, from one or more notches in the surface of the metal. Notches concentrate the stresses of operation at the base of the notch, and greatly reduce the number of stress reversals available before the commencement of failure.
   3. Those cracks resulting from corrosion fatigue, wherein the notch effect created in the bottom of minute corrosive pits caused by electrolytic action, concentrates the stresses of operation at the base of the notch, and reduces the maximum number of stress reversals available before commencement of failure.
3. Mill defects (See Figs. 1, 2, 3, 4, 5, 6, and 10).
   Occur: At any point along the length of the pipe.
   Cause: Laps, seams, inclusions, upsetting discontinuities, and die and reamer marks.
4. Handling defects.
   Occur: Over entire length of joint on outside surface, i.e., with relation to scars and gouges. Slip cuts and tong mashes occur within a 6-ft length from the ends of the joint. Elongation generally at the upset runout and in severe cases along the length of the joint.
   Cause: Worn tools, careless and rough handling, and pulling stuck pipe to free it.
5. Internal defects (See Figs. 2, 3, 4, 7, 8, 9, and 10).
   Occur: Throughout the entire length of the joint.
   Cause: Internal corrosive pitting, and mill defects consisting of laps, seams, inclusions, upsetting discontinuities, and die and reamer marks.
6. Box and pin defects.
   Occur: Either in the threaded section or in the body of the tool joint proper.
   Cause: Improper makeup, careless handling, faulty manufacturing or improper installation.

B. Techniques employed to reduce service failures of drill pipe.

There has been a considerable reduction in service failures from all causes during the last two years in the West Texas-New Mexico area. This reduction may be attributed to better operating techniques developed by the independent and group research of the contractors, mills, and independent research organizations. A brief discussion of each of these techniques follows:

1. Use of drill collars: Two years ago most contractors were using only a small number of drill collars. Today, it is an almost universal practice to employ long strings of collars to keep the pipe string in tension. This lowers bending stresses in the pipe, eliminates column distortion caused by compression load, and adds greatly to the service life of the pipe.

2. Use of salt string: Many contractors today, after drilling through the salt zone, use a separate string of drill pipe, which has never drilled in salt, to complete the hard-rock drilling in fresh water muds. Usually, the string that has never drilled in salt is picked up after the salt zone has been cased off. To prevent salt contamination, the mud tanks are flushed thoroughly and new fresh water mud is made up. Although this practice is not so universal as that of using long strings of drill collars, it has been used widely enough to offer conclusive evidence of its effectiveness. An increasing number of contractors are adopting the procedure each day. Two years ago, the technique was almost unheard of, although a few had tried it experimentally.

3. Reduced speed of rotation: It has been observed also that practically all drilling operators have reduced the speeds of rotation, particularly in the hard-rock areas. Operating stresses are thereby reduced to much safer levels with a resultant decrease in failure expectancy.

4. Use of smaller diameter pipe: There is also a trend toward the use of smaller diameter drill pipe as drilling depths increase. Observed results of this practice have been good, although it is not uniformly employed at this time. The object of this technique is to pro-

*Presented before Southwestern District API Division of Production, San Antonio, Texas, April 14-16, 1948.

[1]American Inspection Service, Midland, Texas.
[2]Superior Oil Company, Midland, Texas.
[3]Western Plastic Company, Inc., Midland, Texas.
[4]Toboscope Company, Odessa, Texas.

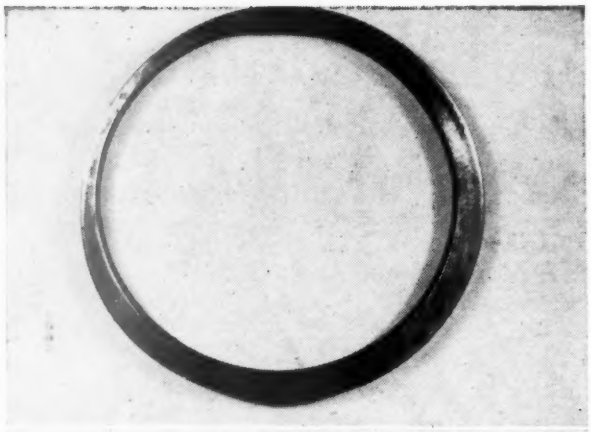

FIG. 1. Cross section showing reduced body wall in new 4½-in. drill pipe as a result of eccentric rolling.

FIG. 2. Cross section of internal seams 4½-in. drill pipe (new).

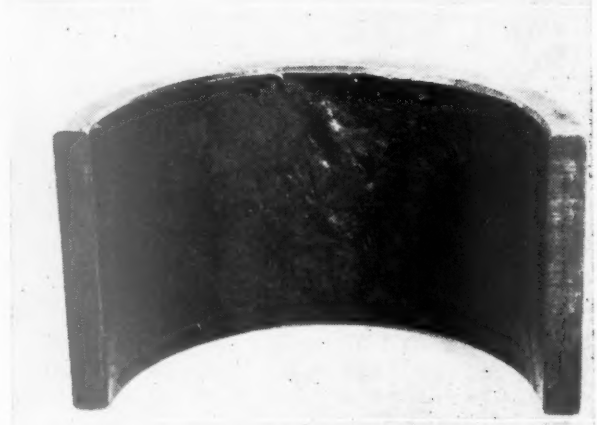

FIG. 3. Internal slag inclusion new 4½-in. drill pipe.

FIG. 4. Longitudinal splits in new 4½-in. drill pipe.

FIG. 5. Section of 3½-in. drill pipe in which the mill inclusion has pumped out during drilling service.

vide a more flexible drill string to absorb the increased loads.

5. Use of field inspection: An important factor in the reduction of drill pipe failures during service has been the increased use of improved field inspection services for the detection of fatigue cracks, corrosive pitting, and points of stress concentration which may lead to failure. The principal object of inspection is to detect and thereby facilitate the removal from the active drilling string of incipient breaks. In this manner, failures are prevented from occurring in the hole. The subject of field inspection is given further detailed discussion later in the paper.

6. Use of protection methods: A number of methods of protecting drill pipe have been used in the field. The most successful methods thus far tried have been shot peening, use of chemical inhibitors, and use of plastic coatings. These three protection methods are discussed in detail later in the paper.

Although a very great deal has been written concerning the effect of changes in rig operation techniques and equipment on the reduction in number of in-the-hole failures of drill pipe, very little information has been advanced on field inspection and on protection methods. In view of this fact, this paper treats in detail these two very important methods now being employed in the Permian Basin in an effort to further reduce drill pipe failures.

● **Drill pipe inspection.** *A. General.* A majority of the operators are now periodically employing inspection on their strings and weeding out defective joints. The interval between inspections is variable and is based on the operating experience of the individual drilling contractor. Some operators determine the necessity for inspection on the basis of washouts and cracks located by their crews on trips in and out of the hole, while others base the need on actual failures in the hole causing fishing jobs. Both situations actually are failures, and are considered as such by the inspection services for the purpose of recording results of inspections. The average time between inspections is every second to third well, or after drilling 18,000 ft to 30,000 ft of hole.

B. Magnetic particle method. With the advent of the magnetic particle method, external inspection has been more greatly improved than any other phase of the entire inspection operation. The method, widely used for more than 15 years in many industries, was applied to drill pipe work approximately 3½ years ago. A controlled magnetic field is introduced into the pipe, usually in a longitudinal direction, by means of a coil carrying a low-voltage, high-amperage current. As this magnetic field flows along the pipe, transverse defects such as fatigue cracks, mill laps, seams, and inclusions offer a reluctance to its passage, resulting in some of the field pushing out into the external air at the defect. A north-south pole is set up on either side of the defect, creating simply the effect of a horseshoe magnet. A finely divided steel powder, especially selected for its magnetic char-

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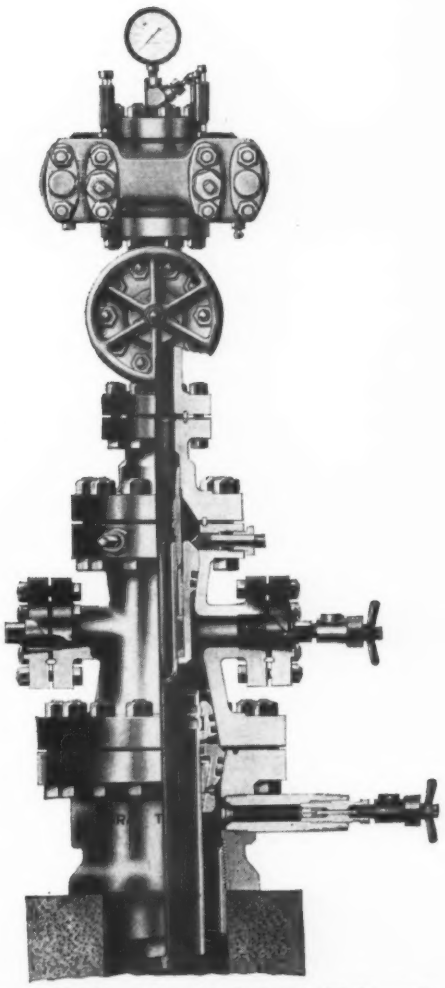

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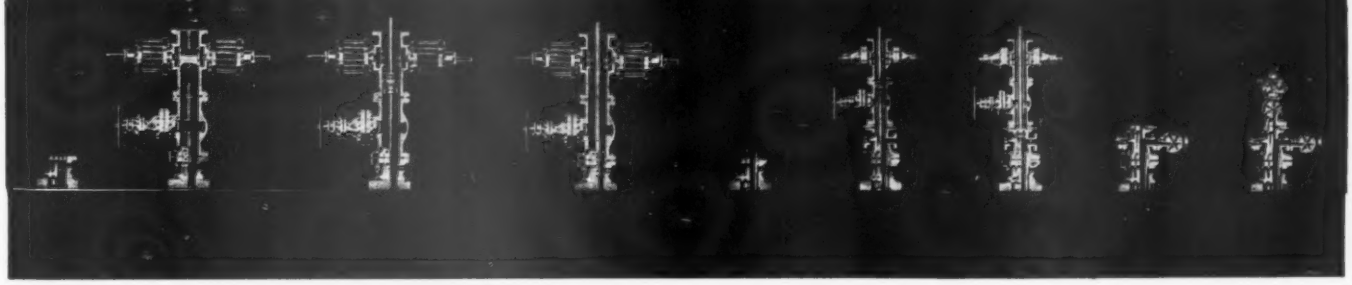

acteristics, is applied to the surface area being inspected. When these particles come in contact with the external field set up by a defect, they are attracted thereto and align themselves in a pattern along the extent of the defect, clearly outlining it. In other words, the powder particles, having some degree of length and breadth, serve as the "bar" that is placed across the horseshoe magnet.

At present, the magnetic particle method appears to be the only method employed by the various inspection services that removes most of the "human" element in its application. Table 1 shows the average percentages of defects found by the inspection services during recent years. It is believed that the majority of these defects could not have been located by visual inspection alone. The Battelle Memorial Institute has been conducting research for more than a year in an effort to develop a better method for non-destructive testing of drill pipe. A recent progress report indicated that approximately 300 patented methods had been investigated and results revealed that none of these methods offered any improvement over the magnetic particle method now employed.

C. Internal inspection method. Internal inspection of drill pipe is still accomplished by means of an optical instrument for viewing the internal wall of the pipe, lighted by a mercury vapor light mounted in the head of the instrument. The disadvantages of this method of inspection lie in operator fatigue, optical limitations of the instrument, and inability of the instrument to reveal to the operator minute and tight-lipped cracks. However, its effectiveness has been enhanced greatly by better internal cleaning methods developed and adopted during the last two years.

Sandblasting of the internal surface and the use of an acid bath followed by wire brushing to remove loosened scale deposits have brought marked improvement to internal inspection and result in complete cleansing of the internal surface. All mill scale, which not only hampers the inspector, but reduces the service life of the pipe in corrosive fluids, is removed by these two methods of cleaning. Laboratory tests and field observation show that removal of scale retards the corrosive action, and promotes longer service life.*

The combination of the magnetic particle method externally and better cleaning internally have led to better interpretation of the findings of the inspector, resulting in a lower margin of error, and consequently a lowered failure rate between inspections.

D. Inspection personnel. The standard of inspection personnel has improved in the last two years, with the return of many men from the armed services. The training of good drill-pipe inspectors is a slow and laborious process. To be a good safe inspector, one should have a basic understanding of metallurgy and of stress conditions under which drill pipe operates. He should have a knowl-

*Battelle Memorial Institute Report No. 7 to American Association of Oilwell Drilling Contractors, February 15, 1947.

FIG. 6. Fatigue crack that has developed in the bottom of a mill inclusion pit.

FIG. 7. Cross section of 4½-in. drill pipe showing advanced corrosion as a result of drilling in the Permian Basin.

FIG. 8. "Ringworm" type corrosion in used 4½-in. drill pipe. Note fatigue crack that has developed.

FIG. 9. Fatigue crack resulting from corrosive pitting—used 4½-in. drill pipe.

FIG. 10. Section of new 4½-in. drill pipe showing penetration of internal seam.

FIG. 11. Fatigue cracks in used 4½-in. drill pipe detected by magnetic particle inspection.

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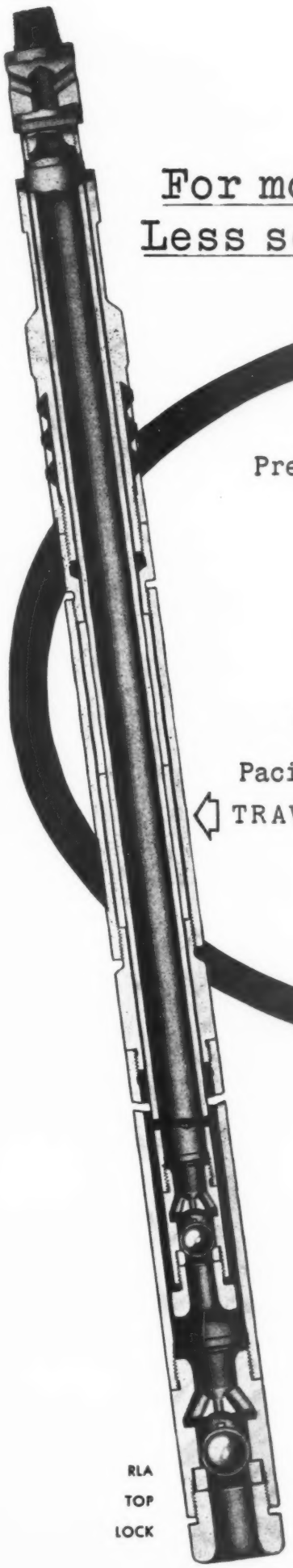

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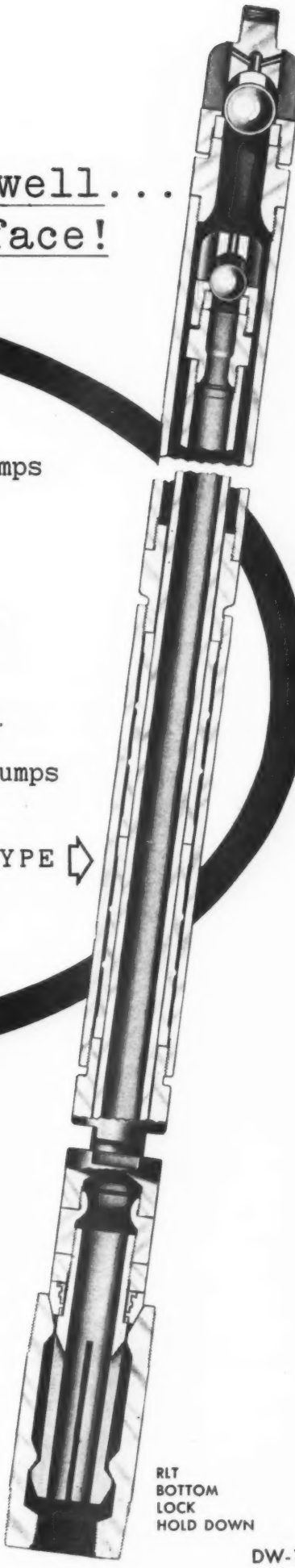

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edge of fatigue and its effects on drill pipe; and he must thoroughly understand his processes of inspection. The training period should include study and lecture courses in addition to field experience under fully trained and experienced inspectors. Programs of inspector education along these lines are being followed by most of the various inspection services.

E. Standards of rejection. The standard of rejection is followed uniformly by the inspection services using the above-mentioned processes. Several inspection processes, which are being tried at this time or have been tried in the last two years, involving electronic or radiographic principles, follow somewhat varying and different standards of rejection. It has been impossible, however, to arrive at any conclusive set of standards for some processes:

1. New pipe: One of the most controversial questions that has arisen in the past few years is that of the standards to be followed in the rejection of mill defects in new pipe. The mills have taken the position that mill defects are not harmful unless they extend more than 12½ per cent of the wall thickness. This tolerance is allowed by the API Code. The inspection services have taken the position that such defects could be harmful regardless of depth, unless they can be ground out without setting up a further notch condition or materially affecting the wall thickness.

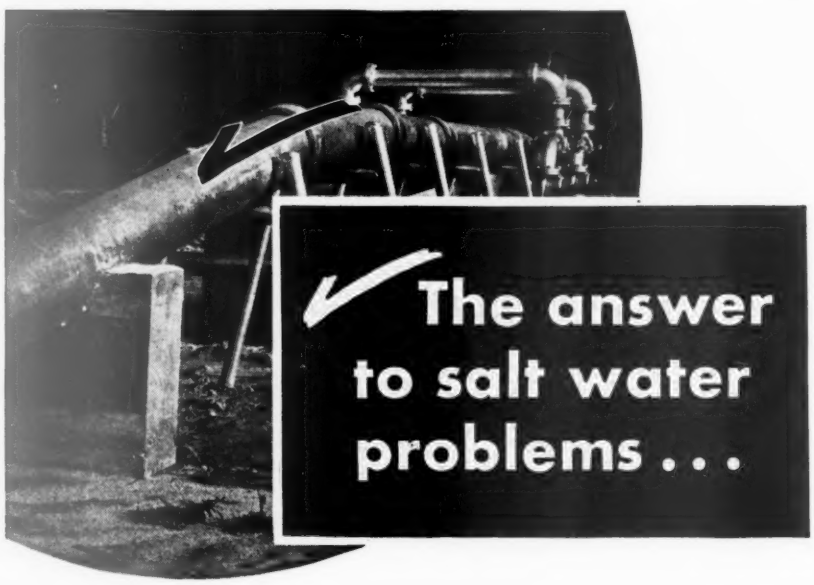
The mills generally contend that no failure has been traced directly to a mill defect. On the other hand, the inspection services have traced numerous failures directly to mill defects. (See Figs. 5 and 6).

It is possible that the tolerances allowed by the API Code are too liberal since this code was established before present severe drilling loads were encountered. It is expected that additional information regarding the effect of mill defects on the life of drill pipe will be obtained from several strings now drilling which are made up of pipe containing known mill defects.

2. Used pipe: Rejection standards on used pipe are fairly uniform and are agreed upon by the inspection services. Fatigue cracks on external surfaces are rejected unless they can be ground out without creating a further notch condition or materially affecting the wall thickness. External abrasive wall wear in excess of 20 per cent of the original wall thickness is the basis for rejection of pipe used for deep drilling. Quite often rejected pipe is used in shallow drilling areas and obtains good footage. Pipe containing external discontinuities such as slip cuts, tong mashes, deep scars and gouges, pitting and mill defects is rejected on the basis of depth, size, direction, and location on the pipe. Transverse discontinuities are more quickly rejected than longitudinal discontinuities. Pipe containing internal pitting is rejected on a basis of pit depth and concentration. Pipe containing internal mill defects is rejected on the basis of size, depth, location, and direction of the defect. In the overall consideration of whether a defect or discontinuity should be rejected, the conservative view must be taken by the inspector, since the object of inspection is to prevent failure of the pipe in the hole.

Of the two inspection services operating in the Permian Basin, one follows the policy of grading the pipe it inspects by number, while the other does not grade the pipe it inspects, but classifies it as either "good" or "bad." Each of the two companies follows a color marking system for the identification of the pipe, according to its condition. This system is not uniform because of the difference in grading and non-grading policies. It seems advisable that a uniform system of color marking be adopted for the benefit of those using inspection service.

Inspection prices have increased approximately 25 per cent in two years as a result of the higher cost of greatly improved cleaning methods. The cost of complete external and internal inspection now averages, including mileage costs, approximately $0.16 per ft on strings that are racked at the time of inspection. In those instances where additional truck time is necessary to put up temporary racks and to place the pipe on those racks, a few cents per joint is added to the above cost. Assuming 30,000 ft as the average footage drilled between inspections by an 8500-ft string, the inspection cost per foot drilled is calculated at $0.045. It is readily seen therefore that the cost of inspection per foot drilled is a minor invest-



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ment compared with the dollar savings obtained in the reduction of failures and increased string efficiency.

● **Drill pipe protection.** *A. Use of chemical inhibitors.* Chemical inhibitors have been used in the drilling fluid to reduce the effects of corrosion. Many operators have found this practice to be helpful; however, some operators have obtained only slight benefits not compatible with the costs, while others have obtained no beneficial results. At this time, consensus seems to be that the benefits to be gained are not justified because of high cost, the difficulty in obtaining inhibitors in sufficient quantities, and the variability of results. Additional research and experience are considered necessary, however, before definite conclusions can be reached.

B. Use of shot peened pipe. A number of companies have employed drill strings that have been shot-peened internally for the full length, and for an area of 24 to 30 in. below the tool joint externally. The effect of the shot-peening is to case harden the surface of the pipe to a depth of 0.006 to 0.010 in., and to set up in this zone, a compression stress. Inasmuch as any fatigue failure must occur from a tension stress, and a tension stress will not progress through a zone of compression stress, the possibility of failure from fatigue is greatly reduced. Of course, once the compression zone has been penetrated by corrosive pitting or mechanical damage, its effect is lost at that area. However, it has been noted that corrosive pitting is greatly retarded over a shot-peened surface. One string was observed that had been in service for several months in a highly corrosive area; 98 per cent of the peened pipe showed no corrosive pitting and 2 per cent showed only a slight amount of pitting, while pipe in the same string that had not been peened was excessively pitted and much of it was rejected on inspection. Other strings of shot-peened pipe have given very good service in this area.

About a year ago, approximately 40 tests were made by two companies to determine the effect on fatigue life of peening the external area of the drill pipe from a point just below the tool joint to below the upset runout. For this experiment, full length joints of both Grade D and Grade E pipe were subjected to rotating beam tests. The unpeened specimans failed at approximately 300,000 cycles, while those that had been peened operated some 6,000,000 cycles before failure. Some additional operating life was obtained on the Grade E over the Grade D.

Within the last two months additional tests were made employing three joints of Grade E pipe unpeened, and three joints of Grade E pipe peened, full length specimens. Again the unpeened pipe failed at 300,000 cycles and the peened pipe at 6,000,000 cycles. Under laboratory conditions, these tests set up a fatigue ratio of 20: 1 of peened pipe over unpeened pipe. Based on these experiments, it seems safe to conclude that shot-peening may be expected to add further to the service life of the pipe.

It may be desirable to protect the peened area with a plastic coating further to preserve its effectiveness from abrasive wear. One test in the field of this type showed that the coating would stay on for a considerable length of time. For this test only one finish coat was applied, with the idea of preventing the area from rusting while in storage. It seems reasonable to conclude that by following the regular coating procedure still better results may be had.

C. Use of plastic coating.

1. Types of coatings: This paper deals only with plastic coating; no attempt is made to evaluate any other type of protective coating.

There are two types of plastics in use today as a protective coating. They are Phenolic base and Vinyl acetate base. There are three methods of applying the Phenolic and one method of applying the Vinyl. The Phenolic is sprayed on and air dried, sprayed on and baked, or dipped and baked. The Vinyl is applied only by spray and is air dried.

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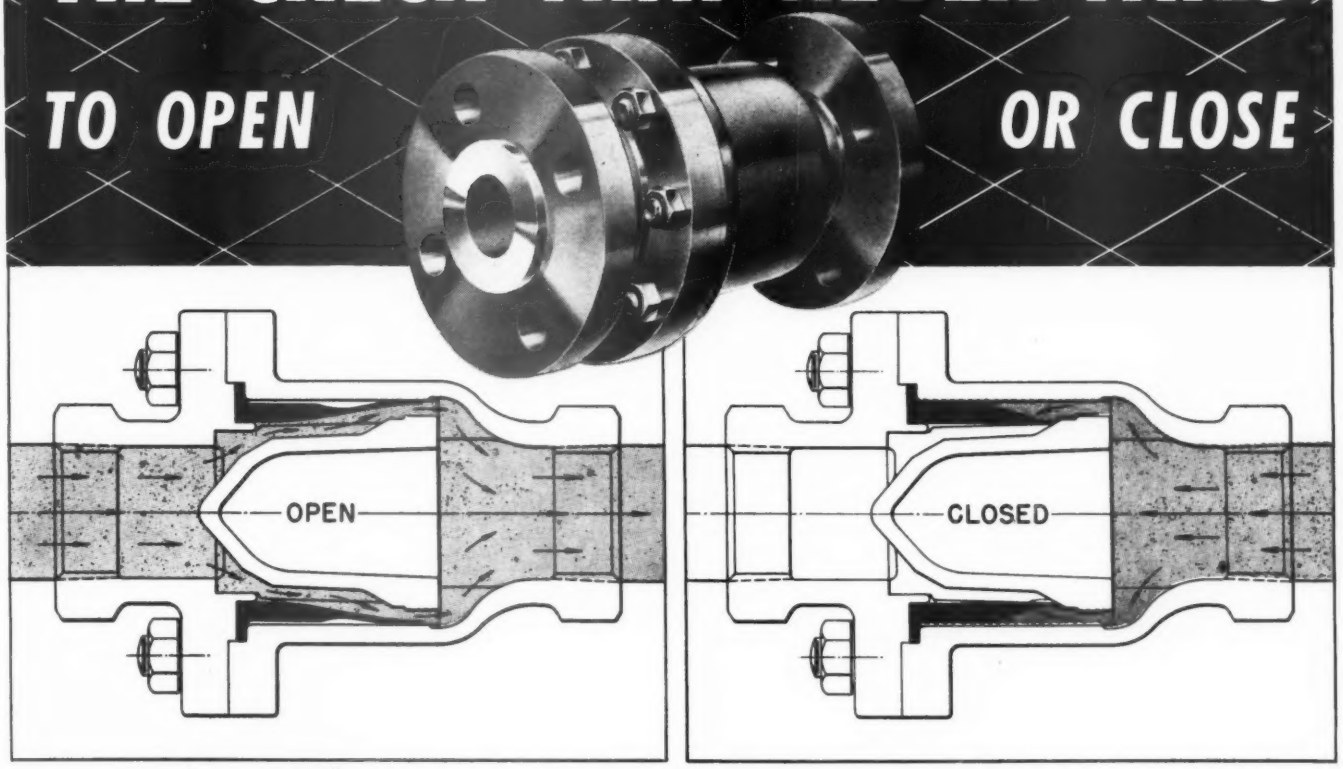

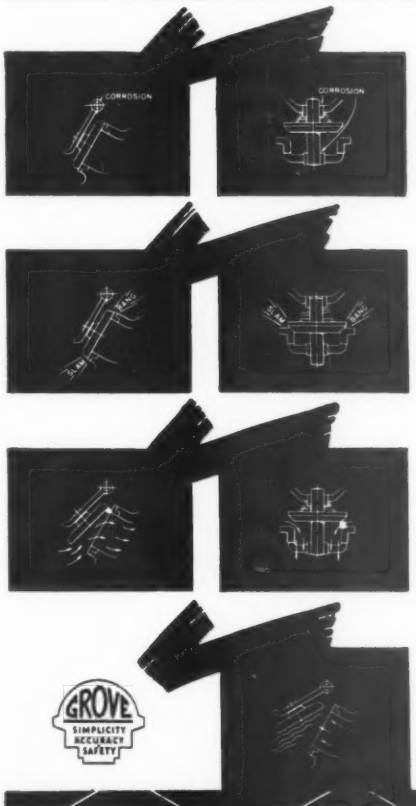

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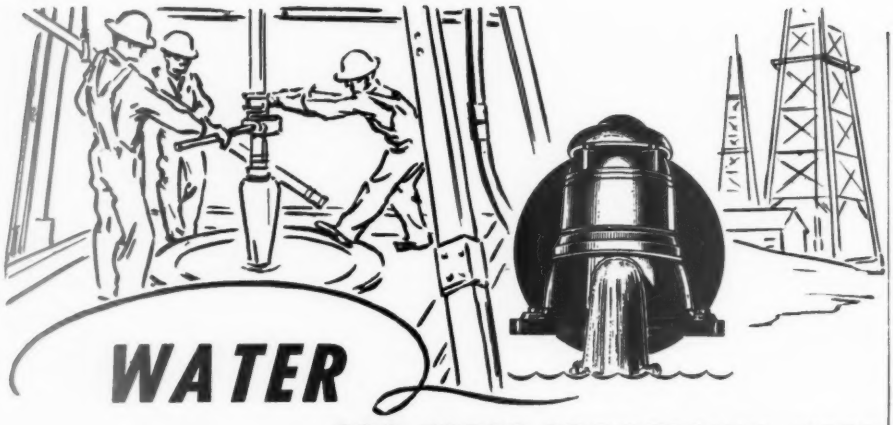

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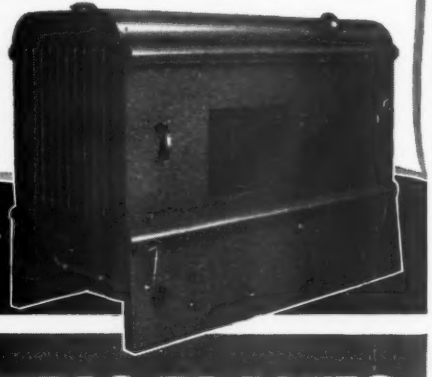

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Some of the physical properties of the Vinyl are:

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(3) Abrasive resistant.
(4) Is not affected by bending, flexing, contracting or expanding.
(5) Is not affected by temperatures from below freezing to 160 F.
(6) Is not brittle and will withstand reasonable impact.
(7) Has a stretch quality of from 180 to 200 per cent.

2. Method of coating:

a. Cleaning: In the application of a protective coating, the most important factor is the bond obtained between the metal and the coating. The condition of the surface to be coated is of prime importance, as a clean surface permits a better bond than one covered by foreign material. At present, the most common method is to blast the surface with an abrasive material. Sand is the most commonly used abrasive. Steel grit and crushed flint also are used. Acid etch is employed to clean used pipe before inspection and before blasting, but, to the author's knowledge, has not been used to date in the preparation of drill pipe for protective coating.

Some operators feel that shotpeening is of definite benefit to the drill pipe. This usually is done in connection with protective coating. After the surface has been cleaned, it is peened before the coating is applied.

b. Application of plastic: The method of application of the Phenolic air dried and the Vinyl air dried is the same. The surface to be coated is cleaned thoroughly. Two coats of primer are applied by spray. The primer is of the same plastic as the finish coat, with special adhesive properties. Four coats of finish plastic are then applied by spray, allowing sufficient time between each coat for the previous one to dry thoroughly.

The first field test of the Phenolic air dried plastic was made in 1942†. We quote from Spang's report of May, 1947, concerning the serviceability of this coating.

"Although 25,000 ft of drilling showed considerable gain in the life of the pipe, the coating did not stand up as well as expected. Large patches had been removed, possibly by the erosive action of the mud, and possibly by some corrosive action, because the pipe surface was found to be pitted and corroded."

There are two methods of applying the Phenolic thermo-setting. The surface is cleaned thoroughly, in each case, by grit blasting. One method is to place the joints in a vertical position and fill them with liquid plastic by pumping it through a connection on the bottom of the bottom of each joint. The plastic is then drained out at a controlled rate. Con-

†Interim Bulletin—May, 1947, by Spang-Chalfant Division of the National Supply Company.

trolling the rate of draining gives some measure of control of the thickness of each layer of plastic. The pipe is set aside and allowed to dry by natural circumstances of air after each coating. After four coats have been applied, it is baked in an oven at a temperature of 450 F until thoroughly fused.

Another method of application of the thermo-setting is by spraying on several successive coats until the desired thickness is obtained, then baking at a predetermined temperature. The final coat is baked at an elevated temperature to fuse and blend the several layers.

3. Analysis of field tests:

Several strings of internally plastic coated drill pipe are in use at the present time in the Permian Basin. One oil company now has three strings in service designated as strings Nos. 39, 32 and 36, and the results of the service tests on these strings are discussed in detail below.

a. Drill string No. 39: One string (identified as No. 39) was put in service December 8, 1945. The string originally consisted of 282 joints or 8527 ft of 4½-in. OD, 20.30 lb, Grade E, Range 2, EUIF seamless. One hundred and forty-one joints, or 4266 ft, were uncoated, 141 joints, or 4261 ft were Phenolic thermo-setting plastic coated. The coated and uncoated joints were placed alternately in the string.

At the end of 103 drilling days and 16,120 ft of hole (in the TXL field, Ector County, Texas), the pipe was inspected. One hundred and sixteen of the 141 joints of uncoated pipe were junked due to internal corrosion pits. Twenty-three joints were sent in to be coated. Three inservice failures had occurred in the uncoated pipe; none had occurred in the coated pipe. Seven joints, or 213 ft, of coated pipe were junked, six due to external pits, and one due to fatigue cracks. The uncoated pipe was replaced with 133 joints, or 4031 ft, of the same weight and grade Phenolic coated, making a total of 267 joints, or 8079 ft in the string.

After drilling an additional 157 days and 29,105 ft of hole, the string again was inspected. Four joints, or 121 ft, were junked, three due to external cuts, and one due to external pits. No service failures had occurred during this period. Twenty-six joints, or 693 ft, were returned to warehouse stock, because they were not needed in the string. The string then contained 237 joints.

At the end of an additional 19 days and 3334 ft of hole, the string was inspected. (It was noted that the plastic coating was being removed from some joints, and was felt that a thorough inspection of the coating should be made). Nineteen joints were junked—15 had internal cracks and 4 had internal pitting. One hundred sixty-two joints were returned for re-coating. Fifty-six joints of the string remained in service. How many of these 56 joints were in the original string is not known. The 26 joints that had been in stock were returned to service. Eighty-eight joints (25 of which were in the original 141 joints of uncoated pipe, and 63 new ones) of Phenolic coated pipe

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J. W. EDWARDS

Ann Arbor, Michigan

were returned to service. One hundred and sixty-two joints that previously were Phenolic coated were Vinyl coated and returned to service, making a total of 332 joints in the string.

At the end of an additional 101 drilling days and 9230 ft of hole, the string was inspected. Of the 332 joints, none was junked. No service failures had occurred. Thirty-nine Phenolic and nine Vinyl coated joints were returned for recoating with Vinyl plastic. Since the last inspection, there has been 64 drilling days, and 6079 ft of hole made. No service failures have occurred and no pipe junked.

The results of the service test of drill string No. 39 are summarized below:

String No. 39 has drilled 63,868 ft of hole in 444 drilling days.

No service failures have occurred in coated pipe.

Three failures have occurred in uncoated pipe.

One hundred and sixteen joints of uncoated pipe were junked after drilling 16,120 ft of hole.

Thirty joints of coated pipe were junked while drilling 63,868 ft of hole—four due to corrosion pits and 26 due to fatigue cracks.

A total of 146 joints have been junked from the string from all causes.

A total of 116 new Phenolic coated joints were used as replacements.

Fifty new Vinyl coated joints were added.

The string has a total of 332 joints in it today.

b. Drill string No. 32; Another string (identified as No. 32) consisted of 255 joints, or 11,244 ft, of 4½-in. OD, 18.10-lb. Grade E, Range 3, seamless, Phenolic thermo-coated pipe. It had been in service 159 drilling days and had made 22,743 ft of hole when first inspected. One joint was junked because of external pits. No service failures had occurred. It is still in service, but has been inspected only the one time.

c. Drill string No. 36: Another string (identified as No. 36) consisted of 92 joints, or 4131 ft. of 5-9/16-in. OD, 25.20-lb, Grade D, Range 3, seamless, Phenolic thermo-setting coated pipe. It had been in service 104 drilling days and had made 22,223 ft of hole when first inspected. Three joints were junked because of external wear. No service failures had occurred. Eighty-nine joints, or 3999 ft of pipe are still in the string. At the end of 146 drilling days and 33,388 ft of hole, the pipe is still running with no service failures and no additional pipe has been junked.

4. Economics of plastic coating: Very little data is available on the field performance of plastic-coated drill pipe. In view of this fact, this discussion of economics is based entirely upon the results of the field test of String No. 39, which is the most complete field test of plastic coated pipe to date.

String No. 39 was received FOB Midland, Texas, at $3.13 per ft, without cleaning or coating. Using the 4266 ft of uncoated pipe and the 16,120 ft of hole as a basis, drilling with uncoated pipe cost 68.1 cents per ft for drill pipe. Assuming the life of string No. 39 is 66 per cent gone, depreciating it accordingly, and adding the actual cost of coating and recoating, plus the full value of junked pipe, it cost this operator 55.74 cents per ft for drill pipe to drill 63,868 ft of hole using coated pipe. Had the 63,868 ft of hole been drilled with uncoated pipe, on the basis of the 141 uncoated joints used in the beginning of this string, it would have been necessary to buy 3.96 additional strings of pipe. Nine fishing jobs also would have been necessitated.

TABLE 1. Defect percentage occurring in total amount of pipe inspected.

Classes of defects	Per cent of total pipe inspected containing 1946-47	1945
Under gauge	4.0	18.0
Fatigue defects	6.0*	4.0*
Mill defects	4.0*	0.2*
Handling defects	2.5*	2.5*
Internal defects	6.0	2.5
Total joint defects	3.5*	7.5*

Recapitulation

	1946-47	1945
Total per cent of rejectable defects	22.5	26.5
Total per cent of repairable or replaceable defects	3.5	7.5
Total per cent of good pipe	74.0	65.99

*Defects normally located by use of magnetic partial inspection.

These figures are based on a weighted average of field inspection data obtained from two major inspection companies operating in the West Texas-New Mexico Permian Basin Area.

If the results obtained with string No. 39 can be regarded as typical, the use of plastic coated drill pipe has proved to be practical both from an operating and economic standpoint.

● **Conclusion.** Although the types of failures discussed herein are now occurring and will continue to occur, their incidence rate has been reduced because of better and improved operating techniques on the part of the contractor. Continued practice of the steps outlined herein may be expected to further reduce the drill pipe failure problem.

The inspection services will improve and develop better and more positive inspection methods; improve present methods of handling drill pipe during inspection, and improve the quality of personnel. Present research points to a much improved internal inspection method in the near future.

On the basis of the results on early field tests, protection of the drill pipe by means of plastic coatings seems to be economically sound and worthwhile. As methods of application and types of coatings are improved, the results may be expected to improve. Cost of application may possibly be reduced as application methods are improved.

The encouraging aspect of the overall picture is that progress has definitely been made; the interest and cooperation of the drilling operator, the mill, the inspection service, and the protective coating service has been aroused and activated toward achieving a mutual goal — better drill pipe service — and concerted action is underway. Concurrence of all who are touched by the problem can be expected to lead to an early end of a costly and worrisome problem.

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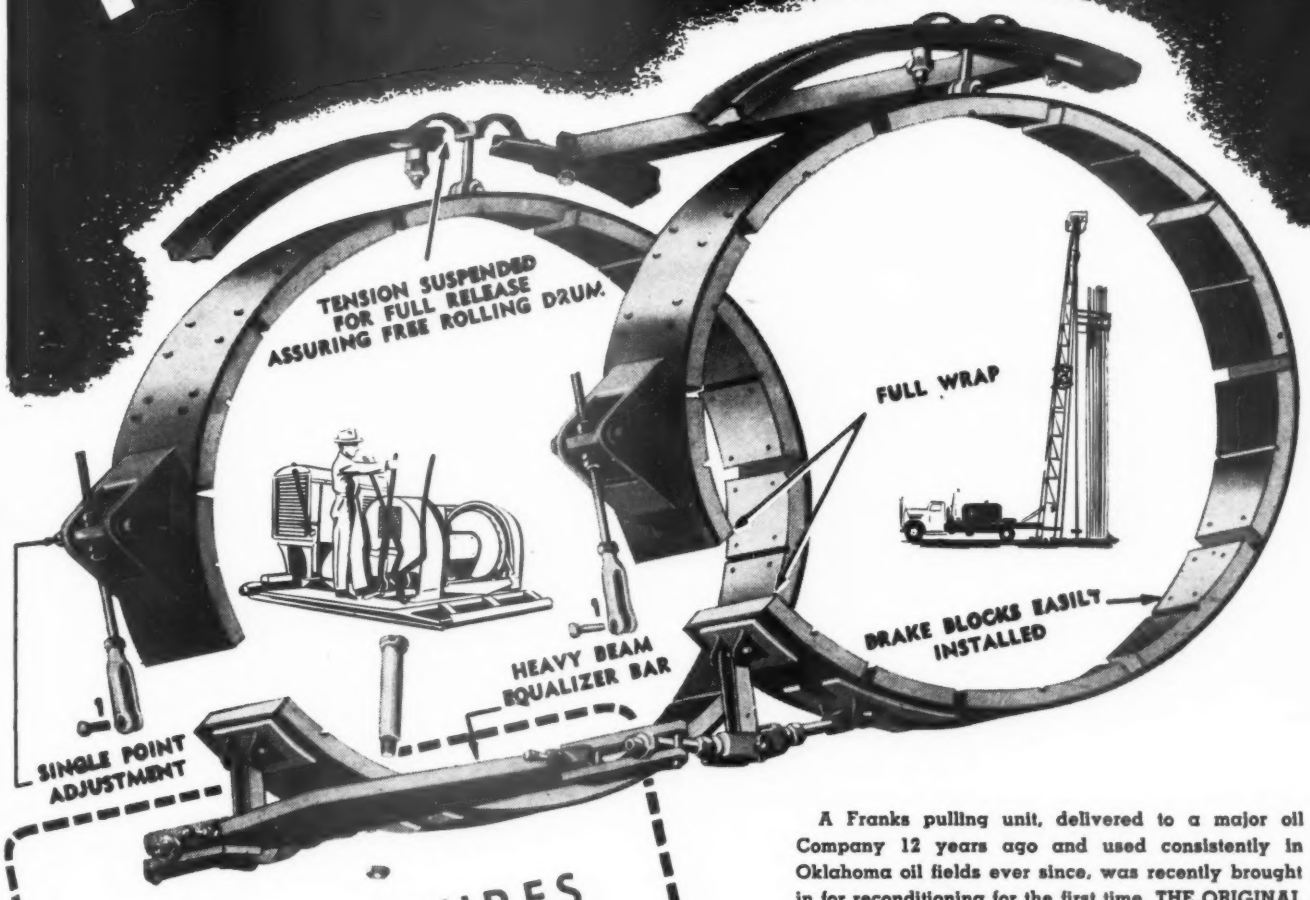
HE MAN

BUT EASY TO HANDLE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A rapid calculation of the specific dispersion of saturated hydrocarbons

By S. G. HINDIN, Houdry Process Corporation

In the analysis of gasolines, the paraffin and naphthene contents are determined after removal of unsaturates.[1] When such removal is by reaction with a surphuric acid-phosphorus pentoxide mixture, the saturate raffinate is usually analyzed to make certain that, at most, only negligible amounts of unsaturates remain. In view of the markedly different values for specific dispersions of saturated and unsaturated hydrocarbons,[2] this laboratory determines the specific dispersion of the saturate fraction as a check for substantially quantitative removal of unsaturates. When using a refractometer designed for monchromatic light, the dispersion is directly calculated. Using an Abbe type instrument with white light, however, the dispersion is calculated as a function of refractive index and drum reading. Such calculation is rather tedious and unnecessary when the only question is whether or not the sample is substantially aromatic and olefin-free.

For the past several years, this laboratory has used a simple chart to determine: (1) Whether the specific dispersion of the saturate raffinate falls in the range 95-100 ($\times 10^4$), and (2) the actual specific dispersion of the sample to No. 1 unit. The chart is prepared in the following manner (drum readings used are for the Valentine Refractometer):

The refractive index and drum readings are arbitrarily taken as, respectively, 1.350 and 42.00. The dispersion is then calculated in the customary manner. Knowing the dispersion, one calculates the density required to give a specific dispersion of 95 and that required for a value of 100 (for that is the spread in values permitted in this laboratory for the saturate portion).

In like manner, the table is extended from a refractive index of 1.350 to 1.510, and drum readings from 42.00 to 43.00. With instruments other than the Valentine model, the values used in calculation will be different, but the principle is still the same. Table I is a portion of the chart in this laboratory.

To use the chart, the refractive index and drum reading are noted for the sample. The density, as previously determined, must then fall within the limits given: A lower value for the density gives a specific dispersion value >100, thus indicating the presence of unsaturates, a higher value indicates a specific dispersion <95, showing an error in the work.

If an actual value of specific dispersion is required, the density figure may be interpolated to yield a result within 0.5 units of the determined value. A few illustrations are given:

Sample no.	20 nD	Reading	20 d_4	—Specific dispersion— Determined	From chart
1163A7	1.4180	42.23	0.746	98.0	98
1259A	1.4000	42.25	0.713	98.7	99
1137A3	1.3737	42.47	0.658	98.1	98

TABLE 1. Drum readings.

Limits of density of the saturate raffinate

Refractive index	42.00	42.05	42.10	42.15	43.00
1.350	0.684—0.719	0.678—0.713	0.672—0.707	0.666—0.701	0.558—0.586
1.360	0.692—0.728	0.685—0.720	0.680—0.715	0.674—0.709	0.566—0.595
1.370	0.700—0.737	0.694—0.730	0.688—0.723	0.682—0.717	0.575—0.605
1.380	0.712—0.749	0.706—0.743	0.700—0.737	0.694—0.730	0.587—0.618
1.390	0.722—0.760	0.716—0.753	0.710—0.747	0.704—0.747	0.599—0.630
1.510	0.942—0.991	0.936—0.985	0.931—0.980	0.926—0.974	0.835—0.879

1. Murtz, Mills, Martin, Harvey, and Lipkin, *Anal. Chem. 19*, 175-182, 1947.
2. Ward and Kurtz: *Anal. Ed. 10*, 559-576, 1938.

★ ★ ★

METERING VS "GUESSTIMATING"

By W. F. SCHAPHORST

The modern trend is to meter everything of importance that can be metered. Not so many years ago, probably within the memory of every reader, there was scarcely a meter in any plant aside from the water meter, gas meter, and electric meter.

Even the electric meter is old as compared with economizing meters that have been developed in recent years. Water, gas, and electric meters were designed and installed solely for the purpose of "selling" water, gas, and electricity to customers. They involved no thought of economy between the seller and the consumer. To install a private meter for measuring one's own steam consumption, or coal consumption, solely for the sake of knowing what was going on was considered as ridiculous as the installation of a cash register by a butcher who was himself the sole owner, dealer, helper, and janitor of the establishment. Today it is considered quite the thing for nearly every store, regardless of smallness or largeness, to have a private cash register, which is really a cash meter for business.

Similarly, it has been found that it pays to know all about the steam, the CO_2, the draft, the temperature, and the coal and oil in one's own establishment regardless, almost, of size. The old method was to operate a plant by sheer force and wealth. There was but little check on anything. The owner or manager simply "guesstimated." If more fuel was needed it was ordered, paid for, and burned.

Today things are decidedly different. An accurate steam meter may be placed on the switchboard any distance from the boilers. The meter tells the entire story—past and present. There is no more "guesstimating" by the owner, manager, or engineer regarding the amount of steam generated by the boilers and the amounts used in the various departments. Total generation and total consumption are carefully and accurately accounted for.

The pyrometer, on the same switchboard, tells the entire story, past and present, about temperatures in the chimney, in the furnace, of the superheater, or anything else of importance. No more "guesstimating" about temperatures.

Draft, CO_2, and fuel are similarly metered and indicated and where desired permanent graphical records are made. There are indicators that show whether the boiler feed regulator is functioning, that show water level, smoke conditions, etc.

Today, as soon as any one of the recorders or indicators shows that things are "going wrong" it is a simple matter to rectify things because the engineer can instantly lay his finger on the cause of the change in conditions The result: fuel is saved. Fuel is expensive today, and it is becoming more expensive from year to year. It has been demonstrated time and again that indicators, meters, and recorders can save much fuel. It is indeed a small plant that cannot make instruments of this type pay and pay *big*.

★ ★ ★

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INSTALLMENT No. 131

A valuable and regular feature of *The Petroleum Engineer*, the Continuous Tables, now in their eleventh year of publication, were designed to save time and effort for the technician and the practical field or plant worker. The tables have proved one of the most popular and helpful departments of *The Petroleum Engineer*. Data are presented in the simplest form available with many types of information included that are best presented by curves or nomographs when three or more variables must be considered simultaneously.

The Continuous Tables have been developed as a result of suggestions for new tables, direct contributions and improvements to existing tables by members of the petroleum and related industries, including manufacturing concerns, who are continually searching for practical information reduced by computation to tabular form readily applicable to the problems daily confronting them that might otherwise necessitate a more or less tedious calculation. These contributions and suggestions from the industry have resulted in a valuable exchange of information and data contributing to the progress of the industry as a whole.

This index will be revised monthly. The index for installments 1-12, inclusive, will be found in the May, 1938, issue; 13-24, inclusive, in the June, 1939, issue; 25-36, inclusive, in the June, 1940, issue; 37-48, inclusive, in the June, 1941, issue; 48-60, inclusive, in the June, 1942, issue; 61-72, inclusive, in the June, 1943, issue; 73-79, inclusive, in the January, 1944, issue; 80-82, inclusive, in the April, 1944 issue; 83-85, inclusive, in the July, 1944, issue; 86-88, inclusive, in the October, 1944, issue; 89-91, inclusive, in the January, 1945, issue; 92-94, inclusive, in the April, 1945, issue; 95-97, inclusive, in the July, 1945, issue; 98-100, inclusive, in the October, 1945, issue; 101-103, inclusive, in the January, 1946, issue; 104-106, inclusive, in the April, 1946, issue; 107-109, inclusive, in the July, 1946, issue; 110-112, inclusive, in the October, 1946, issue; 113-115, inclusive, in the January, 1947, issue; 116-118, inclusive, in the April, 1947, isisue; 119-121, inclusive, in the July, 1947, issue; 122-124, inclusive, in the October, 1947, issue; 125-127, inclusive, in the January, 1948, issue; 128-130, inclusive, in the April, 1948, issue.

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Torrington Corporation, Bantam Bearings Division	(sheet 3) 298	May	P 425.214.
Visco Products Company, Inc.	(sheet 2) 296	May	P 425.214.

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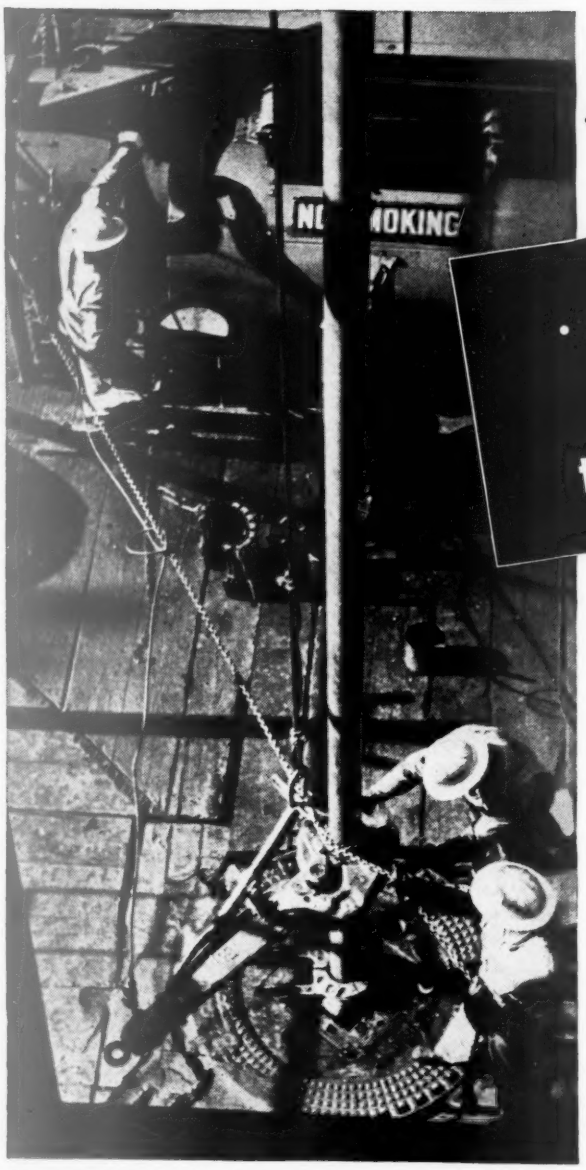

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DESIGN-LIMITATIONS AND PERFORMANCE CHARACTERISTICS OF ROCK BITS

For our experimental work we chose hard formation standard production rock bits in the 6¾-in. size. The formation selected was granite obtained from a quarry near Llano, Texas. The drilling machine was capable of producing a load of 100,000 lb on the bit and a rotary speed of 500 rpm maximum. Clear water was used as the drilling fluid. A new bit was used to drill 2 ft of hole at a given weight and rpm. After all 2 ft drilling tests were completed, the bits were then re-run until they were completely dulled in order to determine the life expectancy of the bit under each drilling condition. All this data is illustrated in curves that will be explained in the following order:

The curves shown in Fig. 5 are the first steps taken in the laboratory to accumulate the data necessary to arrive at the optimum weight and rotary rpm to produce maximum drilling efficiency.

We would like to point out to you that the rate of penetration for each change in rotary rpm is increased as the 2-ft increment of drilling was not great enough to bring into consideration the effect of tooth breakage and tooth wear caused by excessive rpm and weight.

With this preliminary information in mind, we pass to Fig. 6, which contains two curves—one a solid line that shows the rate of penetration for 2 ft in granite vs. the load on the bit, while the other, a dotted line, shows the rate of penetration for 5 ft in granite vs. the load on the bit.

These data are presented to obtain a comparison between the life expectancy of bits run under like conditions for different amounts of penetration. It is interesting to note that the curves are practically the same until after the application of a load of 25,000 lb. This indicates that with a constant rotary speed, the rate of penetration for a shorter interval of time is no better than that for a longer interval of time until after the application of some particular drilling weight to the bit—in this case, 25,000 lb. After this point is passed, the rate of penetration for the longer interval begins to drop off, due to excessive tooth breakage and premature dulling of the cutter teeth. This, of course, clearly illustrates that to maintain maximum rate of pentration for the longest period of time, the bit must not be overloaded to the extent that tooth breakage occurs. Here we have the first indication of an optimum weight for maximum drilling efficiency.

The question often asked is "Which has the most effect on the life of a rock bit, variation in rotary rpm or variation in weight?" The answer to this question has a direct bearing on our topic of discussion; namely, the selection of the optimum rotary speed and load to produce the maximum drilling efficiency. In an effort to answer this question, we have prepared the curves shown in Fig. 7.

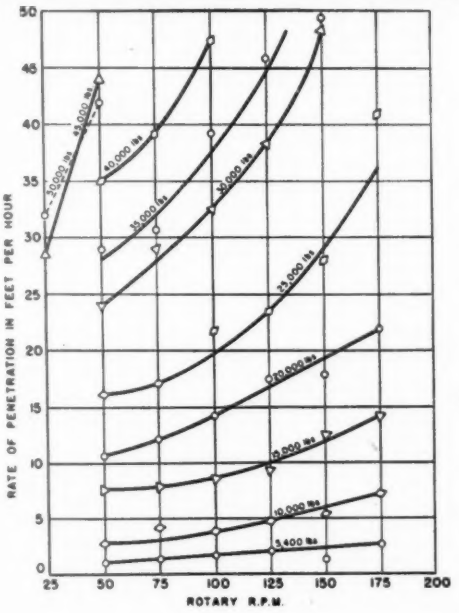


FIG. 5. Effect of rotary rpm variations on rate of penetration arrived at by drilling 2 ft in granite at constant loads.

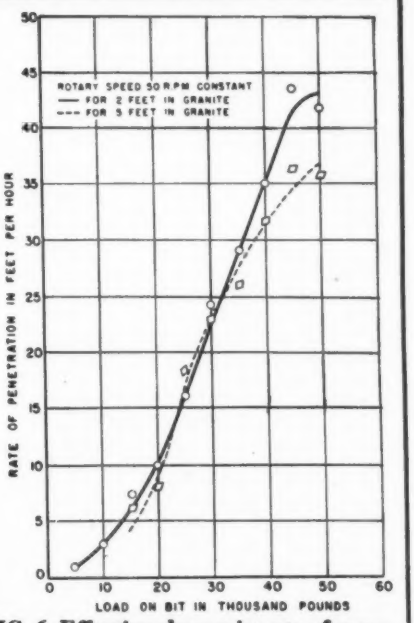
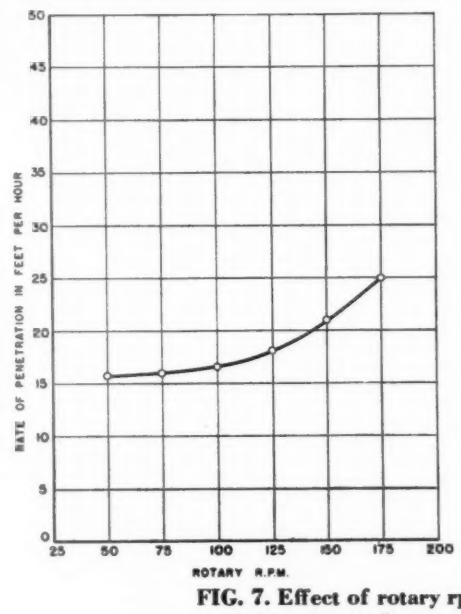

ROTARY SPEED 50 R.P.M. CONSTANT
FOR 2 FEET IN GRANITE
FOR 5 FEET IN GRANITE
RATE OF PENETRATION IN FEET PER HOUR
LOAD ON BIT IN THOUSAND POUNDS

FIG. 6. Effective change in rate of penetration due to an increase in the amount of formation drilled of from 2 to 5 ft at constant rotary rpm and varying loads.



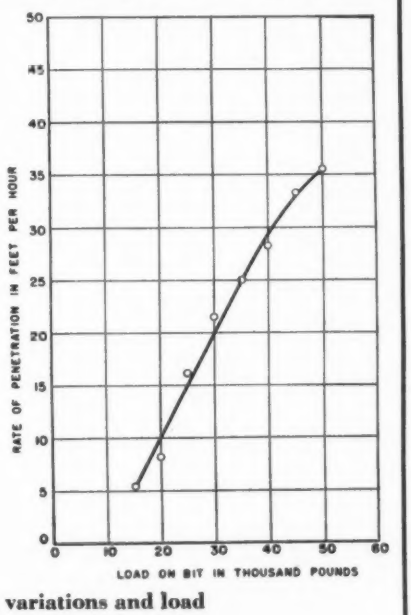


FIG. 7. Effect of rotary rpm variations and load variations on total penetration for life of bit.

A study of the left-hand curve shows that at 25,000 lb and 50 rpm, the total footage drilled by the bit was 15 ft. At 25,000 lb and 175 rpm, the total footage drilled by the bit had dropped to 13 ft. The effect of increasing the rotary rpm under constant load from 50 to 175 rpm resulted in a decrease of the total footage drilled of 13 per cent.

The right-hand curve presents a more drastic reduction in total penetration of the bit as the load is increased. This decrease amounts to 69 per cent, with a load increase of from 15,000 to 50,000 lb. Reduction in total penetration was due to a more rapid dulling of the cutter teeth under the heavier loads. From this laboratory information it is indicated that the answer to our question is that excessive drilling weight shortens the life of a bit more than does excessive rotary rpm.

Taken from the article by Wiley B. Noble that was presented before American Association of Oilwell Drilling Contractors, Long Beach, California, October 13-15, 1947, under the full title of "Fundamental Considerations in the Design of Rock Bits with a Discussion of Laboratory Data on Effect of Weight and Rotary RPM on the Drilling Efficiency of a Rock Bit," published in *The Petroleum Engineer*, November, 1947, pages 141 to 146, inclusive.

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DESIGN LIMITATIONS AND PERFORMANCE CHARACTERISTICS OF ROCK BITS

In the preceding two curves we presented data to show the effect of variation in rotary rpm and weight on the total penetration of the bit in feet. The next two curves, Fig. 8, are presented to show the effect of these variations on the rate of penetration for the life of the bit in feet per hour. The curve on the left plots the rate of penetration for the life of the bit vs. rotary rpm with the weight held constant at 25,000 lb. This curve was prepared by running six bits at rotary speeds varying from 50 to 175 rpm. It is interesting to note that at 50 rpm and 25,000-lb load the overall rate of penetration was approximately 16 ft per hr, whereas at 175 rpm and 25,000-lb load, the overall rate of penetration had increased to 25 ft per hr. Under these conditions, this wide variation in rotary speed increased the rate of penetration only 69 per cent.

The curve on the right was plotted to show the rate of penetration for the life of the bit vs. the load on the bit in thousands of pounds, with the rotary speed held constant at 50 rpm. It will be noted that an increase in the rate of penetration of 700 per cent is indicated between the bit run at 15,000 lb and the one run at 50,000 lb; however, as previously pointed out, the life of the teeth is greatly reduced by the application of more weight These curves also point to the fact that drilling weight affects the performance of a rock bit more than rotary rpm.

Fig. 9 contains the last two curves and combines the information presented in the preceding six curves into a form that illustrates the optimum rotary rpm and weight for maximum drilling efficiency in a given formation. For this figure a hypothetical case was assumed and data presented in previous curves was applied, to arrive at a time required to drill 100 ft of formation, (in this case granite) taking into account the total life of the bit and the trips necessary to change bits. The curve on the left plots total time in hours to drill 100 feet vs. rotary rpm. This curve was arrived at by running bits at a constant load of 25,000 lb, varying the rotary rpm. It will be noted that under laboratory conditions, very little change is noted in the time required to drill 100 ft of hole by varying the rpm. This means that, as the speed is increased, the reduction in the total life of the bit offsets the increase in rate of penetration. As there is no apparent gain in economy by higher rotary rpm, a low speed was selected to plot the data presented in the curve on the right. This curve plots total time in hours to drill 100 ft vs. load on bit in thousands of pounds.

For example, at 15,000 lb and 50 rpm, the total time arrived at for drilling 100 ft was 40 hr. In the ranges of from 20,000 to 26,000 lb, the time required was approximately 32 hr, which is a substantial saving. You will note that loads greater than 26,000 lb indicate a reduction in economy. By the time the weight has been increased to 50,000 lb, the time required to drill 100 ft of hole has increased to 72 hr, which represents an increase in drilling time of approximately 125 per cent. From this curve we see that somewhere in the range of 20,000 to 26,000 lb is the correct weight to apply to the bits, tested in this experiment.

We do not intend to convey the thought that the same figures can be applied directly to field drilling conditions, but we feel that similar weight and rotary rpm combinations can be worked out in the field that will give results similar to those presented.

In closing, we would like to impress upon you that these data apply only to the formation tested and under the laboratory conditions mentioned. These data present a definite pattern for drilling only under these conditions.

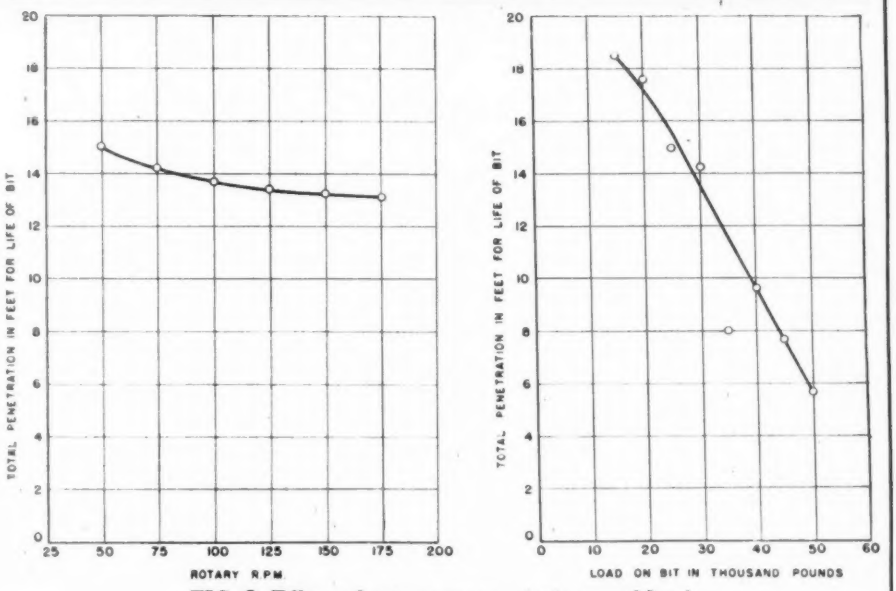
TOTAL PENETRATION IN FEET FOR LIFE OF BIT
ROTARY R P M
TOTAL PENETRATION IN FEET FOR LIFE OF BIT
LOAD ON BIT IN THOUSAND POUNDS

FIG. 8. Effect of rotary rpm variations and load variations on rate of penetration for life of bit.

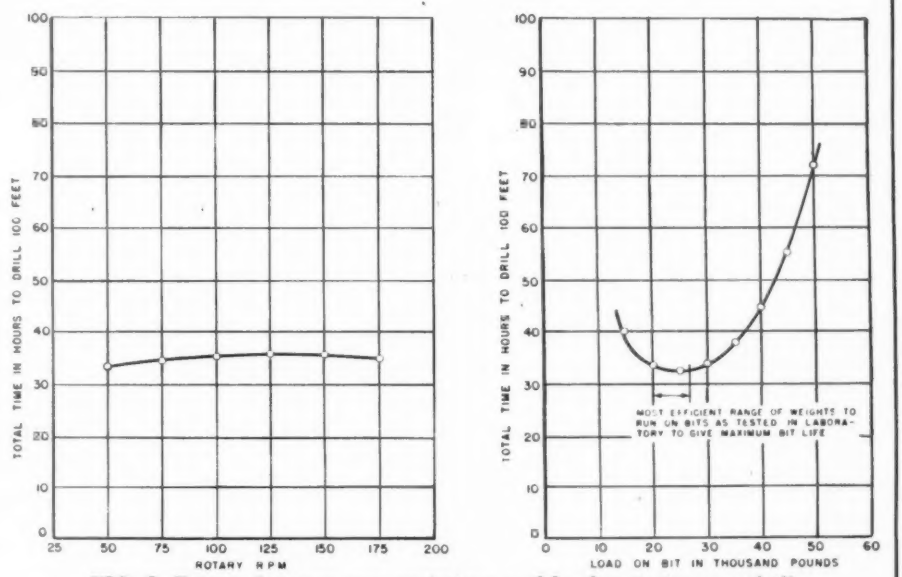
TOTAL TIME IN HOURS TO DRILL 100 FEET
ROTARY R P M
TOTAL TIME IN HOURS TO DRILL 100 FEET
MOST EFFICIENT RANGE OF WEIGHTS TO RUN ON BITS AS TESTED IN LABORATORY TO GIVE MAXIMUM BIT LIFE
LOAD ON BIT IN THOUSAND POUNDS

FIG. 9. Egect of rotary rpm variations and load variations on drilling efficiency of rock bits as expressed in time to drill 100 ft of hole.

Taken from the article by Wiley B. Noble that was presented before American Association of Oilwell Drilling Contractors, Long Beach, California, October 13-15, 1947, under the full title of "Fundamental Considerations in the Design of Rock Bits with a Discussion of Laboratory Data on Effect of Weight and Rotary RPM on the Drilling Efficiency of a Rock Bit," published in *The Petroleum Engineer*, November, 1947, pages 141 to 146, inclusive.

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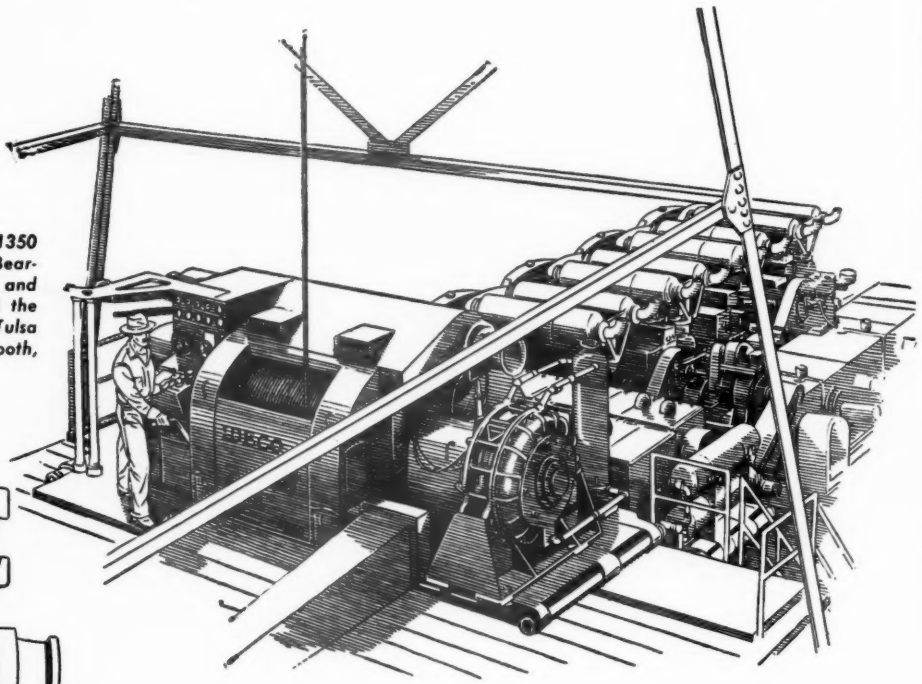

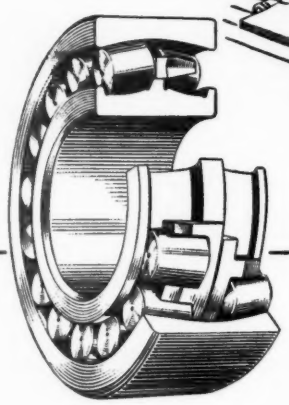

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ECONOMICS AND ANALYSIS OF OIL WELL EQUIPMENT CORROSION PROBLEMS

Rapid and severe corrosion of oil well subsurface equipment, and subsequent failures due to corrosion, constitutes a major economic and technical problem. Usually, the costs involved first come to the attention of company management and then all technical personnel may have immediate cause for concern.

Although much remains to be done concerning pumping well corrosion, it may be that we have sufficient information to set forth a few rules concerning corrosion in given areas.

1. The corrosion is due to water.
2. Where the corrosion is severe, the water has certain general characteristics.
3. Severe corrosion takes place simultaneously with water increase, to a rather definite ratio, depending on characteristics of oil and water.

These rules are few and simple but they allow certain predictions that are helpful in any area where the nature of the water is known and where future water-oil ratios may be forecast with reasonable accuracy.

● **Comparison of costs and conditions in various areas.** A comparison of subsurface equipment expense for various areas is given in Table 1. This comparison shows only western Kansas to be generally corrosive. It will be noted also that the most important item in Kansas is the tubing costs.

There are a few "hot spots," or strongly corrosive areas within districts, which do not exhibit excessive overall equipment costs. Probably the most notable of these is the group of eight wells in the St. Louis pool, Oklahoma. Table 2 compares Kansas with groups of wells in three other districts. A comparison of conditions in St. Louis, Oklahoma, with those in Kansas is of considerable interest. It will be noted that the percentages in fluid production are closely similar, but there is relatively less tubing expense and more rod and pump expense in the St. Louis wells. Depth of wells is approximately equal. The much larger volume of water produced at St. Louis seems to be a fairly logical explanation. Several wells in the St. James pool, Illinois, are understood to be giving some trouble from corrosion. This might be predicted from the nature of the water and the per cent water produced.

The comparison of 15 non-corrosive wells from Seminole, Oklahoma, with 76 Kansas wells merits some consideration. The percentages of fluid production per well are very closely similar. The Seminole wells actually produced more fluid per well, and from approximately 1000 ft deeper, than the Kansas wells. The Seminole wells, however, had very little tubing and pump expense. Rod expense was closely similar but the Seminole rod expense was evidently due to heavier loads rather than to corrosion.

A comparison of the brines produced in various districts is given in Table 3. It will be noted that H_2S occurs in the corrosive areas but that all H_2S areas are not necessarily corrosive. Both theory and practice strongly indicate that other factors are equally important. Amounts of water produced and percentage of water must be taken into consideration. Conceivably, the percentage of water at which corrosion became severe should be modified appreciably by characteristics of both oil and water, and of course the depth of pumping. These modifications actually seem to be in effect when characteristics are compared in the various brines. On the basis of H_2S content, the water from New Mexico should be the most corrosive of all; however, this water seems to be "buffered" at a relatively high pH value by the large amount of calcium bicarbonate present. Similarly, the brine from the St. James pool, Illinois, should be rather strongly corrosive, even though it contains only a small amount of H_2S. Such indications are obtained, not very accurately, from the pH values. Only one of these values was obtained in the field and it is believed that all would be appreciably lower if they had been obtained in such manner. for example, loss of CO_2 and H_2S causes the Kansas brine to have a pH well above "7", after it has been open to the air for a few hours.

TABLE 1. Subsurface costs and production data. Annual per well production and operating expense due to corrosion.

Field or state	Seminole, Okla.	Kansas	New Mexico*	Illinois	Michigan
No. wells tabulated	235	76	347	300	16†
Water, bbl	55,484 (85.1%)	107,600 (93.1%)	8,258 (18.3%)	20,457 (72.6%)	16,904 (80.2%)
Oil, bbl	9,722 (14.9%)	8,030 (6.9%)	36,739 (81.7%)	7,720 (27.4%)	4,190 (19.8%)
Tubing expense	117	689	7.20	32.90	0
Rod expense	176	361	0.51	109.90	16
Miscellaneous subsurface expense	351	55	26.40	140.10	85‡
Total subsurface expense	643	1,105	34.11	282.90	101

*$49,311.00 ($142 per well per yr) expense for flowing and gas lift is not included. The major portion of this was due to paraffin trouble.
†Four representative wells from each of four pools.
‡Pump and paraffin expense.

TABLE 2. Comparison of corrosive and non-corrosive areas. Well per year data.

Field or state	St. Louis, Oklahoma	Western Kansas	Seminole, Oklahoma	St. James, Illinois
No. wells tabulated	8	76	15*	14
Classification	Corrosive	Corrosive	Non-Corrosive	Corrosive ?
Water	262,184 (92.8%)	107,600 (93.1%)	133,000 (93.5%)	19,360 (78%)
Oil	20,497 (7.2%)	8,030 (6.9%)	9,300 (6.5%)	5,470 (22%)
Tubing expense	363	689	88	39
Rod expense	1,150	361	356	63.60
Miscellaneous subsurface expense	484	55	15	204
Total subsurface expense	1,997	1,105	459	306.60

*Selected for similarity in fluid production to Kansas wells.

TABLE 3. Comparison of brines produced in corrosive and non-corrosive areas.

	St. Louis, Oklahoma	Seminole pool, Oklahoma	Chase pool, Kansas	Hobbs pool, New Mexico	Centralia, Illinois	St. James, Illinois
Per cent water	92.8 Corrosive	85.1 Non-corrosive	93.1 Corrosive	18.3 Non-corrosive	72.6 Non-corrosive	78.0 Corrosive ?
mgm/l. Na	5,263	51,848	8,388	2,845	34,750	30,156
Ca	361	9,136	1,391	483	3,494	1,625
Mg	162	1,721	396	180	1,440	902
SO_4	200	556	1,792	2,000	nil	390
Cl	8,740	100,706	14,818	3,070	63,900	51,520
HCO_3	624	79	701	2,098	109	392
Total solids	15,380	164,046	27,486	10,676	103,693	84,985
Specific gravity	1.013	1.112	1.021	1.011	1.074	1.062
pH	7.2	6.8	6.4*	7.7	6.8	5.7-7.1
H_2S	Present	nil	Present	Much	nil	Slight

*Determined at well.

Taken from the article, "Corrosion of oil well equipment," by L. C. Case, that was presented before the American Society of Mechanical Engineers, Houston, Texas, October 5-8, 1947, and published in *The Petroleum Engineer*, December, 1947, pages 150 to 156, inclusive.

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ECONOMICS AND ANALYSIS OF OIL WELL EQUIPMENT CORROSION PROBLEMS

● **Tubing and rod corrosion, western Kansas.** The corrosion process, which takes place on both rods and tubing, consists of the formation of an iron sulphide film, followed by failure of the film and its repeated formation. Tubing failure occurs most frequently at points of contact of boxes with tubing interior. Although this is somewhat erroneously termed "rod cutting," the actual process is well understood in the field. Pitting frequently takes place, outside the rod-worn areas, and sometimes proceeds through the tubing as fast as the corrosion-wear process. It is believed that pitting is possibly accelerated by galvanic action where the pipe surface remains continually water wet. In contrast, a piece of pipe steel suspended in an asbestos waste salt water disposal line was found to be protected by a coating of FeS, after one month exposure, so that very little corrosion was taking place. The same test in a steel line results in continued pitting. Entry of air greatly accelerates the process, as evidenced in various salt water disposal operations. The possibility of air entry into the pumping wells has finally been satisfactorily disproved. Observations as early as 1936 indicated that air entered the casingheads for only a very short distance, as evidenced by rust on a few top joints of tubing exterior only. More recently, closing of casingheads on a one-year test failed to produce any reduction of corrosion on tubing interior. As oil in the annulus contains H_2S, the reaction of excess H_2S with oxygen to form water and free sulphur would apparently preclude the possibility of oxygen reaching the bottom of a well. This reaction goes to completion in a few hours. Recent field tests, using liquid oil-soluble tracer, introduced in small amounts in the annulus, showed that many days are required for the tracer to enter the produced fluid. The data on this field test are stated in Table 4. A gas in the casinghead would obviously have even less tendency than an oil-soluble liquid to circulate downward.

It seems remarkable that tubing and rod corrosion are not even worse when we consider that FeS-coated surfaces are actually more easily water wetted than steel surfaces. If the FeS film is in contact with oil most of the time, then it may not become water wetted. The inherent ability of the oil, or lack of such ability, to wet the steel surfaces must have a great deal to do with corrosion rates. Kennedy and Rogers[1] have shown that the Kansas oil has little wetting ability. Better wetting ability of the New Mexico oil, coupled with less water production and water that is better "buffered," seems to offer a satisfactory explanation for present lack of corrosion in New Mexico. It is believed, however, that trouble may be predicted for certain New Mexico wells when the water content of fluid increases and they are pumped with rods. This statement is based on records of a few West Texas wells where conditions are similar.

Table 5 illustrates water percentage at the start of corrosion in 48 Kansas wells. The maximum deviation from the average of 85 per cent water is shown to be 15 per cent and the average deviation 5.5 per cent. There are many exceptions to the predictions for Kansas wells that may be based on this tabulation; however, the data are useful in a general way in anticipating corrosion trouble.

● **Anti-corrosion methods.** *Resistant materials, alloys, and coatings.* Early efforts at corrosion prevention consisted of searching for resistant materials. This method has several limitations, the most important one being that of cost. For example, we know that nickel-plated rods and tubing would withstand H_2S corrosion almost indefinitely, but the cost is too high for all but very large producers. Subsurface equipment has been designed largely from the standpoint of strength and steels that are strong and resistant to wear are often quite susceptible to corrosion. Furthermore, dissimilar metals in motion in the presence of electrolyte are common causes of accelerated corrosion. Field tests have shown definitely that we cannot pump with rods through cement-lined tubing. It was found that rod-wear and other failure of the cement lining caused fouling of pumps and resulting stripping jobs. Plastic coated tubing does not offer much promise to date where it is necessary to use rods. Improved coatings and methods of application apparently offer considerable promise for the future where rods are not used. At present, however, field tests show generally that the average life of the coatings on oil-well tubing does not justify the expense of application of the several coats necessary.

Chemical methods. It has been shown that severe corrosion is due to one or more of the following causes: Excessive water, H_2S, low pH, and lack of wetting ability of oil. Chemical treatment should therefore logically attempt the correction of these conditions. It should be noted that water shut-off is a separate and distinct engineering problem. Thus when the engineer asks why corrosion problems have not been solved, the chemist may counter with the question "why produce so much water?"

If we must accept the condition of producing high percentages of corrosive water, then corrective treatment may be outlined essentially as follows:

1. Neutralization, or caustic to react with H_2S and to raise pH value.

2. Precipitation agents to form protective coating. Alkaline compounds to form protective deposit of $CaCO_3$, $BaCl_2$ to form coating, etc.

3. Oil wetting agents to increase wetting ability of oil.

4. Addition agents—to react with H_2S, forming films more easily wet by oil. Formaldehyde is best example.

[1]H. T. Kennedy and W. F. Rogers, personal communication.

TABLE 4. Time required to obtain returns on oil-soluble tracer*

Days	Oil, bbl	Days	Oil, bb
1	22	14	6
2	12	15	8
3	12	16	Rec. T.
4	10	17	8
5	10	18	12
6	10	19	10
7	12	20	15
8	10	21	9
9	12	22	14
10	12	23	14
11	16	24	24
12	5	25	17†
13	10	26	9†

*15 gal CCl_4, mixed with 15 gal crude, added to annulus.
†Tracer showed up.

Well data:
Operating fluid level, 790 ft.
Distance from operating level to tbg. perf., 2482 ft.
Calculated oil in annulus, 2236 gal.
Water production, 520 bbl/day, 24-hr cycle.
Oil-soluble chemical added, 4.5 gal/day.

TABLE 5. Kansas Arbuckle wells. Per cent water production at start of severe corrosion.

Pool	Well	Per cent	Pool	Well	Per cent
Cress	A	88	Kraft	A	91
Chase	A	93	Kraft	B	75
Chase	B	82	Silica	A	89
Chase	C	90	Silica	B	88
Chase	D	85	Silica	C	92
Chase	E	88	Silica	D	88
Eldorado	A	90	Silica	E	75
Gurney	A	70	Silica	F	88
Walter	A	86	Silica	G	85
Sharpe	A	79	Silica	H	82
Sharpe	B	85	Silica	I	75
Sharpe	C	80	Silica	J	95
Sharpe	D	93	Silica	K	80
Stottenberg	A	90	Silica	L	80
Stottenberg	B	85	Silica	M	80
Stottenberg	C	80	Silica	N	91
Wilkins	A	80	Silica	O	80
Wilkins	B	88	Silica	P	95
Wilkins	C	75	Silica	Q	95
Wilkins	D	95	Silica	R	90
Voshell	A	87	Silica	S	86
Sullivan	A	93	Silica	T	93
Burrton	A	75	Silica	U	90
S. Silica	A	90	Silica	V	86

Average 85.7 per cent.

TABLE 6. Tests for formaldehyde in well effluent.

First day		Second day	
Time sampled	Formaldehyde, mgm/l.	Time sampled	Formaldehyde, mgm/l.
9:30 a.m.	300	8:50 a.m.	6
11:25 a.m.	80	11:00 a.m.	60
1:30 p.m.	50	1:25 p.m.	6
4:00 p.m.	30	3:50 p.m.	10

Well data:
Treatment: 9 qt 25 per cent formaldehyde in annulus : t 7:50 a.m. each day.
Pump: 2 in., 23 x 44 spm, 24 hr (460 bbl at 100 per cent eff.)
Production: 30 bbl oil, 376 water per day.
Tubing: 2½ in. Capacity less rod displacement, 16.5 bbl.
Casing: 5½ in. Fluid in annulus: 1000 ft.
Water: pH 6.9, H_2S 10-31 mgm/l.

Taken from the article, "Corrosion of oil well equipment," by L. C. Case, that was presented before the American Society of Mechanical Engineers, Houston, Texas, October 5-8, 1947, and published in *The Petroleum Engineer*, December, 1947, pages 150 to 156, inclusive.

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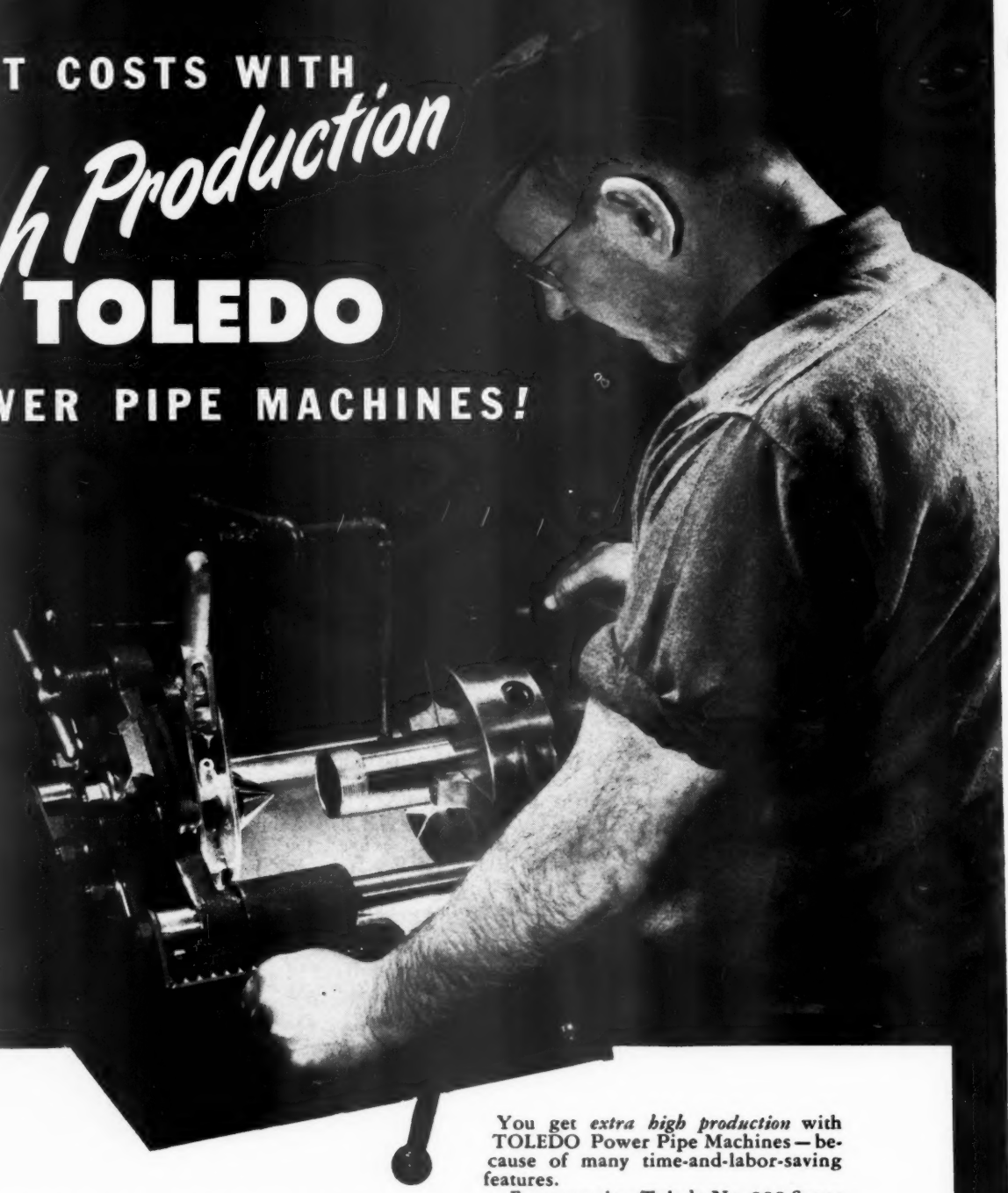

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DESIGN OF MULTI-COLUMN PLANTS FOR DISTILLATION OF NATURAL GASOLINE

The comparison of the direct and inverted series for deethanization and depropanization is limited to a comparatively small range of ethane/propane ratios in the feed because of external factors that are not present in the previous comparisons. If the ethane/propane ratio is greater than approximately 0.6/1, the large amount of ethane and the accompanying methane makes it impossible to obtain complete condensation at 100 F and 450 psig of the overhead product of the first column in the inverted series. A compressor must be used to feed the second column in the inverted series. The qualitative comparison given in Table 3 indicates that the direct series is preferred from an economic viewpoint.

On the other hand, if the ratio of ethane/propane in the feed is less than 0.25/1, as is the condition where deethanization of rich oil is employed in the absorbing-stripping cycle[11], it is possible to withdraw commercial propane as a sidestream from the deethanizer. This is due to the high volatility of ethane referred to propane (about 2.5/1). The one column operation, withdrawing propane as a sidestream, requires a fired reboiler or about 400 psi steam, but this is more than compensated for by the saving of one distillation column and its auxiliary equipment.

It is believed necessary to compare the inverted series with the direct series only when the ethane/propane ratio in the feed is between 0.25 and 0.60. One actual comparison at the ratio of ethane/propane = 0.32 (ethane plus propane being 23 per cent of the feed) indicates that the cost of inverted series relative to direct series operation is about + 40 cents per 1000 gal of feed. This incremental cost is due to the higher pressure column and the additional pumps required for the inverted series.

It is recommended that in a new plant, the ethane-and-lighter fractions of the natural gasoline be removed in the first column of the distillation series.

Many existing plants do not separate ethane from propane, either because of the small ethane content or the desired low recovery of commercial propane. If it becomes necessary to install a deethanizer because of anticipated higher ethane concentrations or desired increased recovery of propane, two general recommendations can be made:

(1). The use of the inverted series is more economical if the overhead product from the existing column can be completely condensed, because of the smaller diameter needed for the new deethanizing column. Many plants have found it possible to use sections of pipe for such a deethanizing operation, the pipes being either packed or fitted with piston-type bubble plates.

FIG. 7

CONCLUSIONS FOR NATURAL GASOLINE PLANTS

1. REMOVAL OF ETHANE AND PROPANE
   - A. NEW PLANT—USE DIRECT SERIES.
   - B. ADDITION TO PLANT WITH EXISTING DEPROPANIZER, USE INVERTED SERIES, IF ETHANE CONTENT IS NOT TOO HIGH.
2. REMOVAL OF ISO-BUTANE AND NORMAL BUTANE (NEW PLANT OR ADDITION TO EXISTING PLANT)
   - A. USE DIRECT SERIES (OPTIONAL).
   - B. IF HAVE LARGE GASOLINE RECYCLE TO STILL, USE INVERTED SERIES.

(2). If the overhead product from the existing column cannot be condensed, it is believed that direct series is more economical, although this case should be investigated for each specific separation. If direct series operation is to be used, the new column must operate at 450 psi and be sufficiently large to handle the large liquid load. If inverted series be used, compressors are required to feed the second column, and the new column must operate at 450 psi but will have a smaller diameter because of the smaller liquid load.

● **Sizing of distillation columns.** Process engineers generally use shortcut approximate methods of design for economic comparisons. The design procedure given here has been used for a number of years with satisfactory results. This procedure is recommended only for preliminary estimations, although some distillation columns have been designed on this basis (and operated successfully). The final process design should be made by more accurate methods.

The procedure recommended for estimating purposes includes the calculation of the minimum number of theoretical liquid-vapor contacts and the minimum reflux ratio, which represent the limiting or boundary conditions of actual operation. Emphasis is placed upon the sequences of deethanizing, depropanizing, deisobutanizing, and debutanizing of natural gasoline.

This paper presents economic comparisons of a number of possible process arrangements of distillation sections in present day natural gasoline plants. Equipment such as vapor lines, reflux lines, reflux drums, valves, instruments, and pumps that are common to all sequences are eliminated from consideration.

● **Summary and general conclusions.** The overall operation of distillation sections containing three or four columns may be considered by combining the "unit" studies made above. General conclusions for typical natural gasoline plants are indicated in Fig. 7.

Conclusions reached in the unit studies also apply to many refinery operations. For example, the feed to the distillation section of a typical butane-alkylation unit has a low propane/isobutane ratio, a high isobutane/n-butane ratio, and a small concentration of gasoline. Figs. 4 and 6 indicate that the preferred sequence of distillation is separation between isobutane and n-butane in the first column, with the overhead product sent to a depropanizer, and the bottoms product sent to a debutanizer.

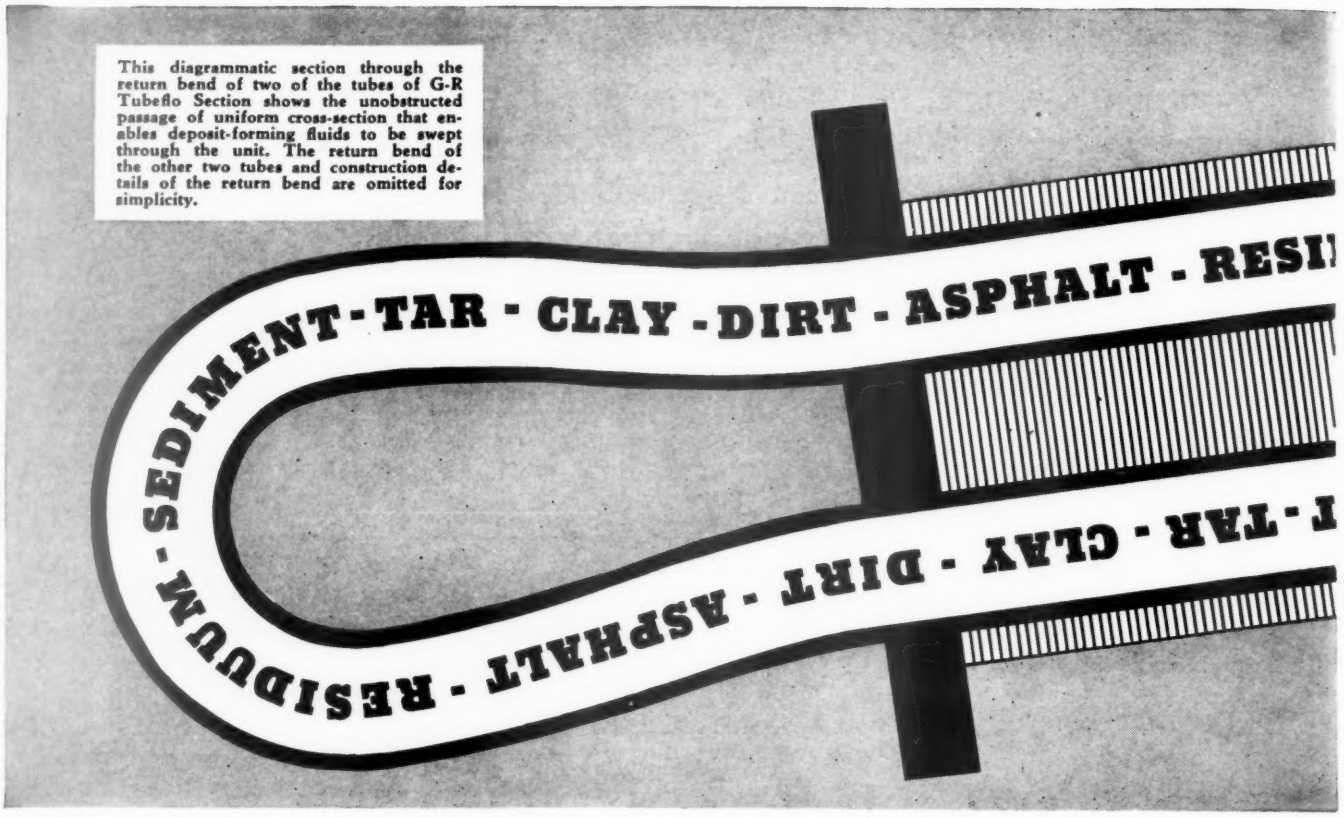
The rule-of-thumb saying so often heard, that it is better to reduce the pressure level of the distillation system as soon as possible (implying direct series operation), appears to be generally true only for large increments of pressure in the high pressure range above about 200 psi. In other cases, the relative amounts of the products is the deciding factor. If the lightest product is present in large amounts, direct series is preferred; if the heaviest product is present in large amounts, inverted series is preferred.

● **Literature cited.**

1. Brown and Lockhart, *AIChE Transactions*, *39*, 63 (1943).
2. Brown and Martin, Ibid *35*, 679 (1939).
3. Colburn, Ibid *37*, 805 (1941).
4. Drickamer and Bradford, Ibid *39*, 319 (1943).
5. Fenske, *Ind. Eng. Chem.*, *24*, 482 (1932).
6. Gilliland, Ibid *32*, 1101 (1940).
7. Gilliland, Ibid *32*, 1220 (1940).
8. O'Connell, *AIChE Transactions*, *42*, 741 (1946).
9. Souders and Brown, *Ind. Eng. Chem.* *26*, 98 (1934).
10. Underwood, *AIChE Transactions* (London), *10*, 119 (1932).
11. Whistler, *California Oil World*, First Issue October 1946, p. 15.

★ ★ ★

Taken from the paper, "Multi-column Distillation of Natural Gasoline," by Frank J. Lockhart that was presented before California Natural Gasoline Association, Los Angeles, and published in *The Petroleum Engineer*, August, 1947, pages 111 to 118, inclusive.



This diagrammatic section through the return bend of two of the tubes of G-R Tubeflo Section shows the unobstructed passage of uniform cross-section that enables deposit-forming fluids to be swept through the unit. The return bend of the other two tubes and construction details of the return bend are omitted for simplicity.

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Here is a heater . . . cooler . . . exchanger . . . steam generator . . . that enables you to recover heat from *any* dirty or heavy fluid without fouling. The G-R Tubeflo Section is superior to all other designs of heat transfer apparatus for this type of service because it has a single tube per pass, with no pockets or dead ends; and provides continuous high velocity of fluids through passages of uniform cross-sectional area.

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And this exclusive feature is only one of many advantages of the G-R Tubeflo Section. Your inquiry is invited.

●

In the G-R Tubeflo Section each fluid flows through two parallel tubes arranged in two passes. The four tubes of the Section are expanded into closely-spaced diamond-shaped fins which bind the four tubes together and transfer the heat from the hot tubes to the cold tubes. All pipe connections are at one end of the unit, and the return end of the unit floats freely on change in in temperature.

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EFFECTS OF DESALTING CRUDE OIL ON REFINERY EFFICIENCY

TABLE 1. Electric pilot plant data. Desalting of Hastings and Mixed Coastal crudes.

Crudes:	Crude designation — Mixed Coastal	Hastings
Water and sediment, per cent (by centrifuge)	0.05	0.05
API gravity	38.3	31.3
Salt, ptb NaCl*	20.6	22.5
Added water designation	Well water	Well water
Emulsion, per cent water	15	15
Treating temp., F	190	190
Expected flow rate	Normal	Normal
Desalted crude:		
Water and sediment, per cent (by centrifuge)	0.08	0.1
Salt, ptb NaCl	0.8	1.8
Effluent brine, pH	8.7	8.3
Salt, ptb NaCl	565	575
Sludging tendency	Nil	Nil
Salt removal, per cent	96.0	92.1

*ptb NaCl=Total chlorides expressed as pounds of sodium chloride per 1000 bbl of oil. To convert to grams of salt per bbl (42 gal) of oil, multiply ptb by 0.453.

TABLE 2. Electric pilot plant data. Processing tank bottoms and added water investigation.

A. Crude inspection

Designation	API gravity	W. & Sed., per cent	Salt, ptb Nacl
Charge to No. 2 C.U.	31.3	0.11	26.3
Tank bottoms, No. 2 C.U.	30.5	10.0	1565

B. Dedalting date

Composition of charge	Water used	Emulsion, per cent water	Salt, ptb NaCl In	Salt, ptb NaCl Out	W. & Sed., per cent In	W. & Sed., per cent Out
100% No. 2 C.U.	No. 2 tower	15	26.3	1.0	0.11	0.09
95% No. 2 C.U. + 5% No. 2 Tank btms.	No. 2 tower	15.7	165	1.3	0.7	0.06

C. Water analysis

Designation	Well water	No. 2 cooling tower
Color	Clear	Greenish
Turbidity	None	Slight
Dissolved solids, ptb	640	1450
Total chloride, expressed as NaCl, ptb	460	1110
Sulphides, expressed as H_2S, ptb	None	None
Calcium, expressed as Ca, ptb	8.8	20.2
Magnesium, expressed as Mg, ptb	3.5	9.1
Sulphate, expressed as SO_4, ptb	None	2.8
pH	8.2	8.6
Alkalinity, to pH 8.3, expresse as $CaCO_3$, ptb	0	8.8
Alkalinity, pH 8.3 to 4.3, expressed as $CaCO_3$, ptb	112	414

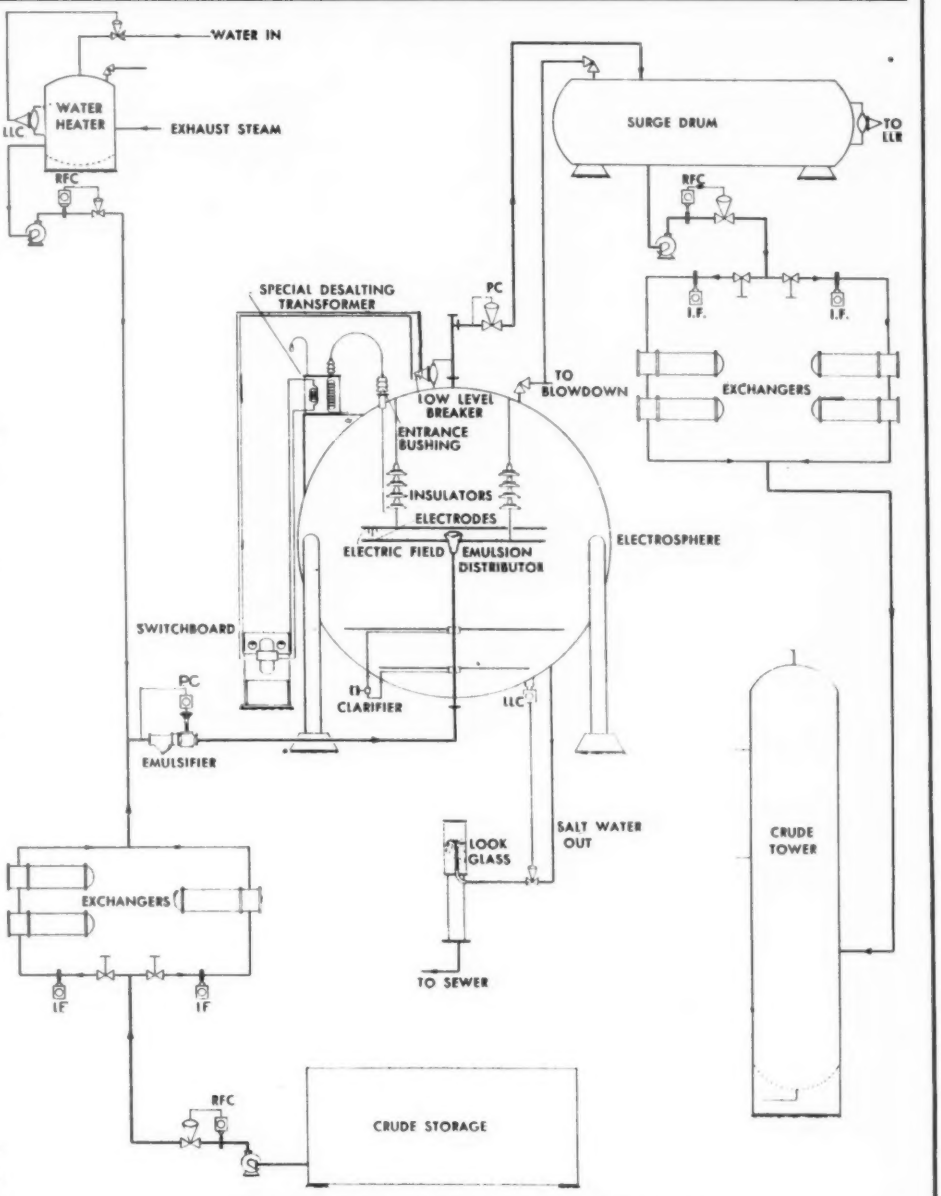

FIG. 1. Electric desalter—crude desalting facilities, No. 2 combination unit at Texas City.

To summarize the effect of salt in the crude and the resulting necessary changes in operation:

(1). The loss of crude preheat makes necessary the reduction of crude throughout in order to maintain adequate preheat temperature. Also, operation at a minimum preheat temperature decreases fractionation efficiency and is particularly noticeable in the quality of the virgin gas oil produced.

(2). The quantity of reduced crude is decreased, which requires a reduction in visbreaker once-through charge rate.

(3). Salt and coke formation in the visbreaker once-through furnace tubes cause excessive inlet pressures, overheating and sagging of the tubes, and make it necessary to reduce the transfer line temperature.

(4). The crack per pass is reduced on the once-through coils and the visbreaker tar gravity is accordingly increased with the reduction in once-through transfer line temperature.

(5). The overall effects of excessive salt in the crude are: Low crude rate and short runs with excessive down time and high labor costs, more frequent equipment replacements due to corrosion, and excessive strain on equipment.

Tables 1 and 2 show the results of tests and analyses of the crude oil stock and water to be used in the electric desalting plant. Fig. 1 is a diagram of the desalting plant, which operates in the following way:

Salt-bearing raw crude is pumped from storage through heat exchangers to the desalting plant. Water is heated to 125 F by contact with exhaust steam and pumped into the hot crude stream. The mixture, 95 per cent oil and 5 per cent water at 210 F, then flows through an air-operated emulsifier, which disperses the water into the crude. The emulsion then flows into the electrosphere, where it is distributed into the electric field and subjected to a voltage gradient of several thousand volts per inch.

Desalted crude is discharged from the top of the sphere into a 10-ft by 40-ft surge drum. A centrifugal pump takes suction on the surge drum and charges the desalted crude through additional exchangers into the crude flash tower.

Taken from the exclusive article, "Desalting crude oil," by W. A. Bonawitz, N. A. Koneman, and M. C. Hopkins, of Pan American Refining Corporation, published in *The Petroleum Engineer*, November, 1947, pages 98 to 110, inclusive.

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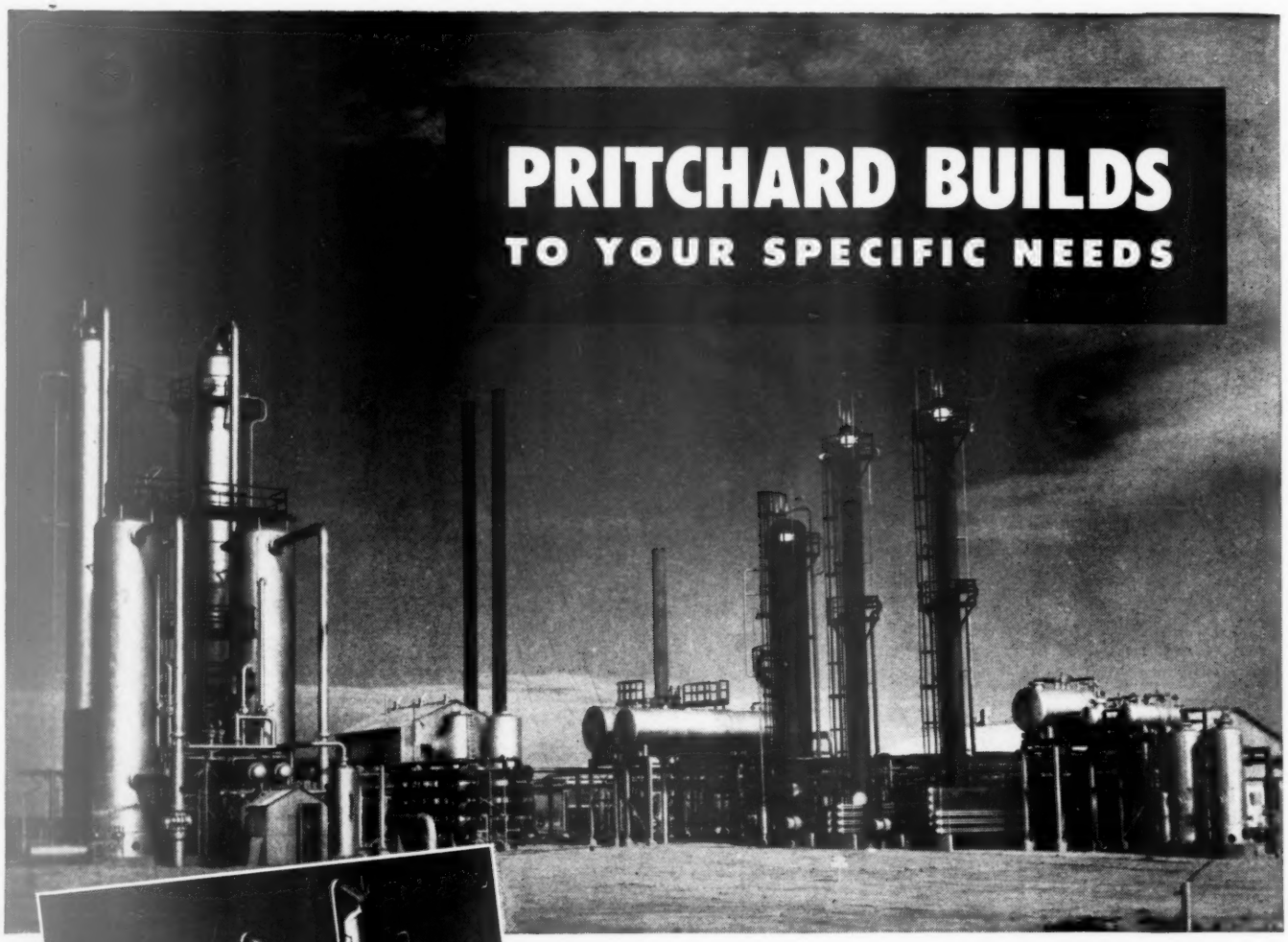

HYDROCARBON RECOVERY and DEHYDRATION

The installation (shown above), designed and constructed to extract gasoline from natural gas, has recently been completed by J. F. Pritchard & Co., Petroleum Division.

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EFFECTS OF DESALTING CRUDE OIL ON REFINERY EFFICIENCY

TABLE 3. No. 2 cracking unit run summaries.

Before desalting

Run no.	Hr on stream	†Service factor	Cause of shutdown
41	930	78.8	Salt fouling of the crude preheat exchangers and visbreaker once-through furnace coils.
42	590	88.2	"
42A	425	83.4	"
42B	828	72.7	"
43	842	83.5	"
*43A	615	86.6	"
43B	152	74.5	Ruptured upper roof tube in the visbreaker once-through coils.
43C	786	79.8	Failure of elbow on crude preheat exchanger. Scheduled shutdown two days later for salt removal.
44	1157	72.1	Failure of furnace-oil stripper reflux line.
45	691	83.6	Unit-shutdown March 8. Ruptured roof tube in visbreaker once-through coils caused by excessive heating due to salt deposits.
Avg.	702		

After desalting

45A	2172	89.8	Heavy coke deposits in the high pressure evaporator.
46	720	90.6	Fire in convection section of the visbreaker furnace.
46A	857	92.6	Leak in blow-down line on the visbreaker furnace.
46B	1370	½ 82.3	Voluntary shutdown for general cleaning and repairing.
47	2705	89.0	"
Avg.	1565		

*In determining service factor this long shutdown period due to labor trouble was compensated for by allowing four days for cleaning and repairs and neglecting the remaining down-time.

$$\dagger \frac{\text{On stream time}}{\text{On stream time} + \text{down time}} \times 100$$

TABLE 4. Comparative data on No. 2 cracking unit.

	Before desalting	After desalting	Improvement (difference)
Service factor, per cent	79.9	89.3	9.4
Crude rate, bbl per stream day	38,922	46,111	7,189
Crude rate, bbl per calendar day	31,102	41,184	10,082
Average run length, hr	*702	1,565	863
Down time, days	73.3	39.0	—34.3
Cleaning exchangers, man-hours	26,813	10,638	—16,175
Cleaning furnaces, man-hours	11,239	9,680	—1,559
Repairing exchangers, man-hours	6,418	3,065	—3,353
Repairing furnaces, man-hours	3,486	1,079	—2,407
†Total for exchangers and furnaces, man-hours	47,956	24,462	—23,494
Average V. B. O. T. transfer-line, temp., F	825	860	35
Approximate average preheat temp., F	605	645	40
Average preheat duty, 10^6 Btu per hr	185	244	59

*Run No. 43B was of short duration. If this run were not considered this value would be 763 hr.

†This includes exchangers and furnaces on the unit not directly concerned with the salt problem.

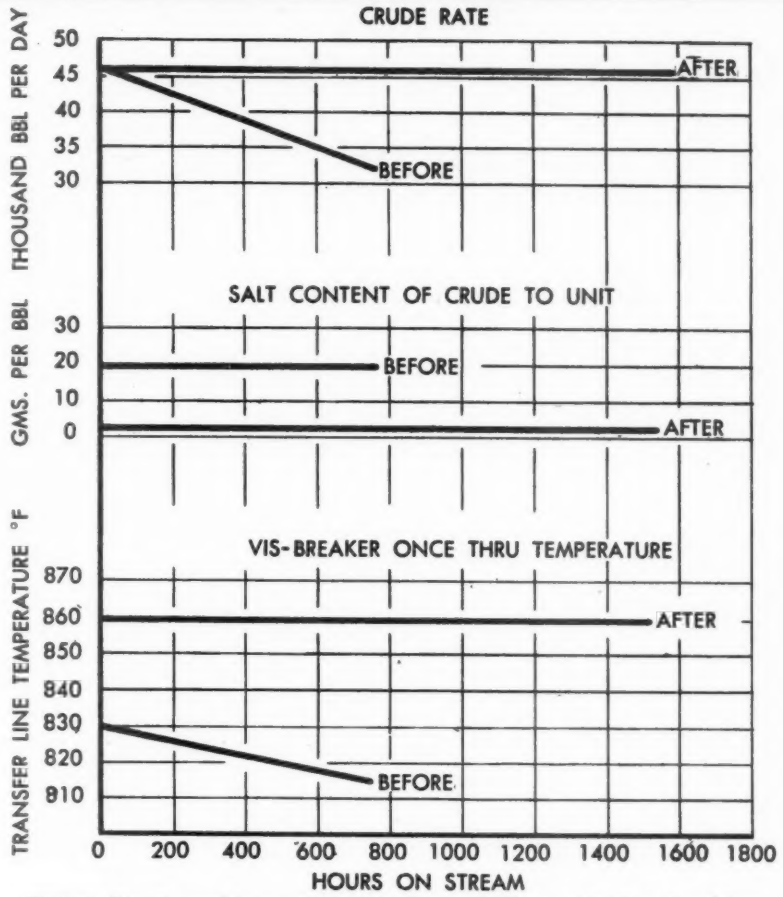

FIG. 2. No. 2 cracking unit—typical runs before and after desalting.

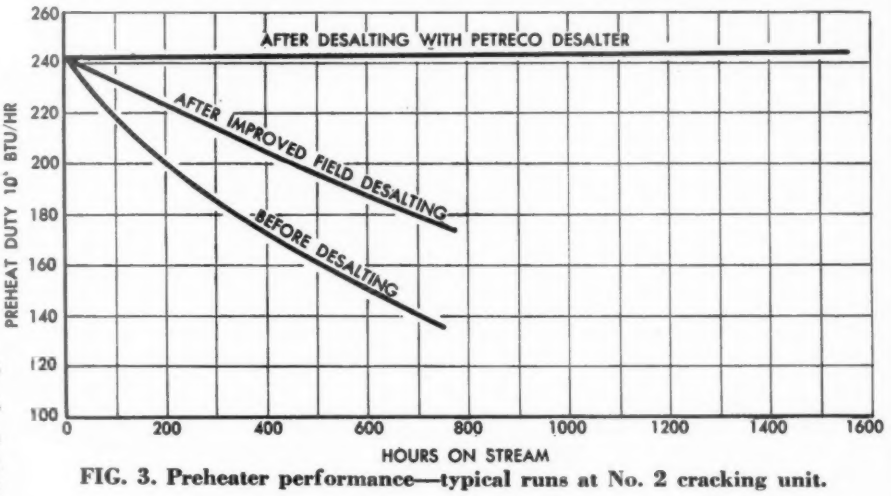

FIG. 3. Preheater performance—typical runs at No. 2 cracking unit.

Fig. 2 presents graphically the run lengths, crude charge rates, visbreaker once-through transfer-line temperatures, and the salt content of the raw and desalted crudes at No. 2 cracking unit for typical runs before and after desalting. These curves show quite clearly the decided improvement in operation as the result of efficient desalting. Table 3 summarizes briefly the run lengths and the reasons for the termination of runs before and after the desalter was placed in operation. Fig. 3 shows the loss in crude-preheat duty at No. 2 cracking unit for typical runs before desalting, after improved desalting in the Hastings field, and after the installation of the desalter.

Table 4 presents pertinent data on evaluating the operation at No. 2 cracking unit before and after desalting. It should be noted that the tabulated man-hours consumed in cleaning and repairing exchangers and furnaces include other exchangers and furnaces not directly concerned with the salt problem. The salt problem has direct bearing only on the visbreaker once-through furnace coils and the crude preheat exchangers. During the "before desalting" period, certain labor disturbances also may have exaggerated differences in these items.

No attempt has been made to determine the decrease in equipment replacements, such as tube bundles and furnace tubes destroyed by excessive overheating and cleaning. The decrease may be appreciable over a long period of time;

Taken from the exclusive article, "Desalting crude oil," by W. A. Bonawitz, N. A. Koneman, and M. C. Hopkins, of Pan American Refining Corporation, published in *The Petroleum Engineer*, November, 1947, pages 98 to 110, inclusive.

QUIZ GAME

Which would you use as a LUBRICANT for ROLLER BEARINGS?

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VARNISH

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RAYON
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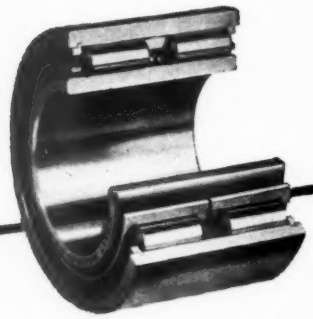
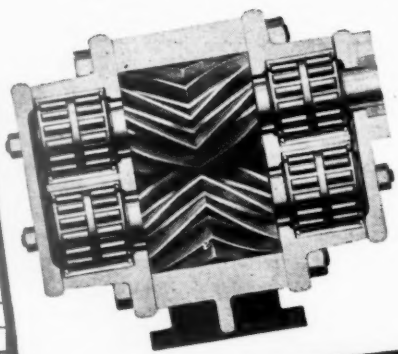


You Can't Lose! Worthington Rotary Pumps handle *all* of the above items—and many more. And the substance that passes through the pump also serves as the *only* lubricant for the four Hyatt Hy-Load Roller Bearings. Periods of service range from 2 to 24 hours a day, and Worthington reports most satisfactory performance: a tribute to Worthington's sound product design, and selection of Hyatt Roller Bearings.



Success in "unusual" applications like this simply goes to show that in any kind of application—wherever you need dependable bearings you *WIN* WITH HYATT. Hyatt Bearings Division, General Motors Corporation, Harrison, New Jersey.

HYATT ROLLER BEARINGS

Merchandising plan

The Pump Division of the Byron Jackson Company, Los Angeles, recently announced a new merchandising plan for its line of Bilt-on pumps. These pumps are general service compact pump-motor units for all types of industrial plants.

L. C. Kimball, general sales manager of the Pump Division, explained that the Bilt-on pumps are designed with interchangeability of basic parts. With eight cases, eight motors, nine impellers, and a stock of small parts it is now possible to assemble a Bilt-on pump that will handle capacities from 10 gpm to 600 gpm at heads up to 340 ft. There are 322 pump combinations available with the plan, according to Kimball, and the units are particularly easy to assemble because the Bilt-on has a single shaft common to both pump and motor. For certain capacities and heads, the impellers need to be machined from 1-12 deg but no other work except assembly is required to meet the ranges described.

Bilt-on pumps being demonstrated by L. C. Kimball, Pump Division sales manager.

A complete sales and engineering manual with graphical solutions for assembly of the basic parts is supplied to jobbers and dealers. The company also reports that there are some districts open for Bilt-on franchises.

Board chairman

Lester Selig, who started work with the General American Transportation Corporation 33 years ago, was elected chairman of the board at the annual meeting held at the New York offices of the company. Max Epstein, who has been chairman, was elected chairman of the executive committee.

After some time in the Warren, Ohio, and East Chicago, Indiana, plants, Selig rose through the accounting and purchasing departments to appointment as assistant superintendent at East Chicago. In 1919, after active service abroad in the armed forces during World War I, he was named assistant to the president and in 1931 was elected president. He was elected vice chairman of the board in 1945.

Other important action at the annual meeting was the election of John P. McFadden of Rockville Center, Long Island, as a director and vice president of the company, to succeed Bennett Epstein, retired. McFadden has been with General American for 33 years. Howard C. Westfall, eastern manager for the tank, storage terminal division of the company was elected assistant secretary.

General offices of the company are at 135 South LaSalle Street, Chicago.

E. G. Price advanced

Edmund G. Price has been elected vice president in charge of operations of the National Tube Company, it is announced by John E. Goble, president. He succeeds E. N. Sanders, who becomes assistant to the vice president-engineering and operations, U. S. Steel Corporation of Delaware.

Price, a native of DuBois, Pennsylvania, was employed at the Lorain, Ohio, plant of National Tube in 1924, serving in various operating positions until 1931, when he became superintendent of blast furnaces there. He was appointed general superintendent of Lorain works in 1941, serving in that capacity until 1944, when he became an executive assistant in the operating department in National Tube's general office in Pittsburgh. He was appointed general superintendent of the company's National Works at McKeesport in 1946, where he served until his election as vice president.

Kennedy officers

The Kennedy Valve Manufacturing Company of Elmira, New York, has announced the election of Charles F. Kennedy as president. Kennedy has been with the company since he was graduated from the University of Michigan in 1937. He was promoted from assistant works manager to vice president and works manager in June, 1947. He is a grandson of the late Daniel Kennedy, who founded the business in 1877.

Chas. F. Kennedy

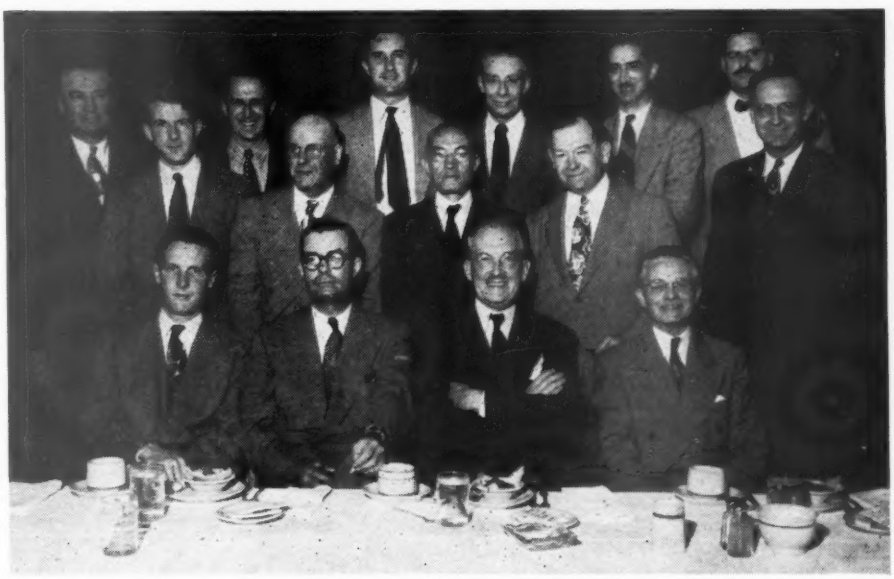
Matthew E. Kennedy, who has been president of the company since 1928, was elected chairman of the board of directors and will also retain his position as treasurer. He has been active in the management of the business for approximately 50 years.

Bakersfield warehouse

A new warehouse has been leased in Bakersfield, California, by Oil Base, Inc., Compton, California, for storing Black Magic oil base drilling fluid. Ed Steele, Valley manager, is in charge.

Houston Nomads hold monthly meeting

Approximately one hundred members and guests attended the meeting of the Houston Nomads on April 7, at the Ye Old College Inn, Houston. Dr. Gustav Egloff, Universal Oil Products Company, Chicago, internationally known authority on the oil industry, was the guest speaker. Dr. Egloff summarized technical and scientific developments taking place in the oil industry, and a questions and answers period was conducted. Visitors attending the meeting are pictured.



Back row: E. E. Eager, Shell-Venezuela; J. Facer, Shell-Venezuela; A. B. Patterson, Cole Drilling Company, Venezuela; R. Davila, Venezuelan consul, Houston; G. C. P. Gifford, Kuwait Oil Company.

Second row: J. D. Bryan, Terminal Drilling Company, Los Angeles; J. Brittain, B.P.M.; Roy Walling, Mene Grande Oil Company, San Tome Terminal, Venezuela; Dr. Gustav Egloff, Universal Oil Products Company, Chicago; Kraus Earhart, The Texas Company, Houston; K. L. Gordon, Richmond Exploration Company, Venezuela.

Front row: P. Pollard, Shell-Colombia; Mont Land, Tretolite Company, Venezuela; James Bradbury, Gulf Oil (ret) Houston; Glenn Byers, Shell Oil, Houston.

CRUDE, CRACKED AND VOLATILE

Big Shot: I'm having a scotch and soda at the bar. What will you have?

Brunette: A husband if it affects you the way I think it will.

* * *

It was their first date and they were both thinking of the same thing. She called it mental telepathy. He called it beginner's luck.

* * *

Engineers had a hard time breaking into the oil business in the old days, and even now run into suspicion. Owen Story, head of the purchasing department of Shell Oil Company in Houston, Texas, tells of one of these engineering trained men reporting for duty on one of their leases. The youngster, just out of school, was interesterd in everything and anxious to learn. Observing a huge crown block assembly, he asked a roughneck, "How do you get this up to the top of the derrick? In segments, I presume."

"Hell, no," answered the derrick man, "we take it up a piece at a time."

* * *

Mrs. Simpleton was being treated for eye trouble, and one day called at the office of the optician.

"Doctor,' said she, "I forgot to ask you about that eye lotion you sent me."

"Well, what have you done about it?"

"Nothing yet," she replied. "Do I drop it in my eyes before or after meals?"

An American had an invitatiaon to a private shoot. Addressing the old gamekeeper, he said: "I'm one of the crack shots in this country. Tomorrow you will be loading for me, and for every bird I miss I'll give you a quarter."

The following evening the gamekeeper met a friend and told him the story.

"If I'd had another blank cartridge," he said "I'd have made an even five dollars."

* * *

A small man was holding forth on humanitarianism. "My friends," he said, "you should never, in any circumstances, strike a child. I've brought up six boys myself, so I know what I'm talking about."

"Six boys!" exclaimed a man in the audience. "Do you mean to say you haven't laid a hand on any one of them?"

"Never," replied the lecturer — "except in self-defense."

* * *

On the rolling boat, far out on the white-capped lake, stood a solitary drunk with his gun on his shoulder. Vainly he attempted to get a bead on the single fast-flying duck passing overhead. Finally, to the keen delight of an observer some distance away, a single shot brought the duck down. As the boat and occupant approached the shore, the following conversation took place:

Observer: Mighty fine shooting, my good man. I have never seen such fine marksmanship under such adverse conditions.

Drunk: Waal, outa the whole flock I oughta get at least one."

* * *

Sam: I thought you said your girl's legs were without equal.

Mike: No, I said they were without parallel.

* * *

Wife, angrily: And I suppose you expect me to believe that you came straight home from the office?

Husband: Sure did; just like the crow flies.

Wife: Yes, so I see; stopping frequently for a little corn.

* * *

A woman wrote to a lonely hearts editor from a very rural spot as follows: "My sister and I aren't exactly lonely out here. We have got each other to speak to, but we need another woman to talk about."

* * *

Husband: Well, my dear, I have carried you safely over all the rough places of life, haven't I

Wife: Yes, and I don't think you missed any of them.

* * *

A man was looking for a good church to attend and happened into a small one in which the congregation were reading with the minister. They were saying: "We have left undone those things we ought to have done, and we have done those things which we ought not to have done."

The man dropped into a seat and sighed with relief as he said to himself: "Thank goodness, I've found my crowd at last."

* * *

Patient: The touch of my nurse's hand lowered my temperature immediately.

Visitor: I can imagine. I heard the slap all the way down the hall.

* * *

"Mother," queried the little tot, "do fairy tales always begin with 'Once upon a time'?"

"No, dear," replied his mother. "They sometimes begin with 'My love, I will be detained at the office tonight'."

* * *

Maybe you can't make a silk purse out of a sow's ear, but many a woman has gotten a mink coat out of an old goat.

* * *

First Bride: I've got my husband where he eats out of my hand.

Second Bride: Saves a lot of dish washing, doesn't it?

* * *

When a pretty girl got on the crowded bus, a pale-looking fellow started to get up. But she pushed him back into the seat, and said she preferred to stand. Again he tried to get up and again she pushed him back. Finally he yelled, "Now listen, lady. I passed my stop two blocks back—let me out!"

* * *

"So your husband is one of the big guns of industry."

"Yes, he's been fired seven times."

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Use the BAKER Cement Wash-Down *Whirler* Float Shoe

(Product No. 120)

A SEAMLESS STEEL SHOE in which a strong concrete plug and plastic valve assembly are securely anchored.

ACCURATELY CUT THREADS to fit any style casing.

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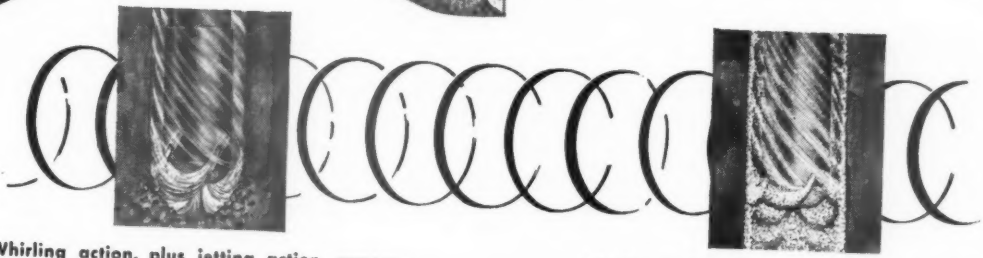

Whirling action, plus jetting action, removes bridges and conditions the hole.

Whirling action reduces hazards of channeling.

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CEMENT WASH-DOWN *Whirler* FLOAT SHOE

running tour with men in the industry

● **G. H. McKay** of Houston, Texas, has been named executive vice president of the East Tennessee Natural Gas Company, Chattanooga, Tennessee. McKay resigned as vice president of the Tennessee Gas Transmission Company to accept the post, according to **Phil B. Whitaker**, a member of the board of East Tennessee.

G. H. McKay

The East Tennessee company has a certificate to build a natural gas transmission system to serve Knoxville and Chattanooga, and towns in Middle and East Tennessee.

"East Tennessee is fortunate in finding a man of Mr. McKay's character and ability to take charge of this enterprise," Whitaker said. "As vice president of Tennessee Gas Transmission Company in Houston, McKay was in charge of sales and brings with him a wealth of knowledge and experience in building and administering a gas transmission system. We will take all our natural gas requirements from the lines of the Tennessee Gas system at Lobelville, and we are fortunate in obtaining a man who can provide the co-operaton necessary between the two companies—the seller and the purchasers."

In Houston, Gardiner Symonds, president of the Tennessee Gas Transmission Company, said that his company accepted McKay's resignation only because it felt that he will contribute substantially to the building up of an efficient and a profitable marketing system in Tennessee. "Our company was formed originally by a group of Tennesseans who had the vision of providing their State with something better in the way of fuel," Symonds stated. "We are happy that we can be of assistance now in helping these people fulfill the vision."

McKay joined Tennessee Gas Transmission Company from the War Production Board, which he joined in 1942 as consulting engineer for the Gas Division of the Office of War Utilities of WPB. He is a native of Jackson, Mississippi, and took his civil engineering degree from Mississippi A & M in 1930. His early gas experience was with the Arkansas Natural Gas Corporation, which he joined as a junior engineer. He was chief natural gas engineer when he left to join the War Production Board.

● **Harold R. Deal**, manager of advertising and sales promotion, Tide Water Associated Oil Company, announces that **Frank W. Dixon**, Berkeley, California, had joined the company's advertising department. Dixon, a graduate of the University of California, prior to joining Associated, was a member of the sales staff of radio station KXOA, Sacramento.

● **W. H. Rowand** has been named chief engineer of The Babcock and Wilcox Company. The position is a new one created by the recent promotion of **Alfred Iddles** to the presidency of the company. Rowand will assume most of the engineering activities previously handled by Iddles.

Rowand has been with The Babcock and Wilcox Company for 19 years. He studied mechanical engineering at Cornell University, class of 1929, and later carried out post-graduate work at Columbia University. During his years with the company he has served in many engineering capacities and has been active in the design and development of boilers.

● **U. R. (Bill) Laves** has recently joined the geological and consulting engineering firm of Kirkpatrick and Bale with offices in the Apco Tower, Oklahoma City, Oklahoma. His postal address is Box 609, Oklahoma City 1.

U. R. Laves

Laves is a graduate of the University of Chicago and has had a wide range of experience in the geological, exploration, and drilling phases of the industry in the Southwest. He was recently engaged in consulting work at Tulsa, and is an active member of several petroleum engineering and geological societies, including the AAPG, the AIME, and the Petroleum Engineers Club of Dallas.

● **Gus Meir** recently moved to Dallas, Texas, from Oil City, Pennsylvania, as director of engineering for Oil Well Supply.

● **Lawrence T. Haugen** has been appointed construction superintendent of Stanolind Oil and Gas Company's manufacturing department, J. E. Rouse, vice president in charge of operations, has announced. Formerly a captain in the U. S. Navy, Haugen was last attached to the Navy's Bureau of Ships in Washington as assistant chief for administration.

With headquarters in Tulsa, Haugen will supervise Stanolind's construction program, which includes the following:

The synthesis project at Garden City, Kansas, which will include a natural gasoline plant, an oxygen plant, the synthesis unit itself, and a chemical refining plant.

A chemical products plant at Brownsville, Texas, to refine the chemical stream from the Carthage Hydrocol, Inc., synthetic gasoline plant.

Six natural gasoline and cycling plants.

It is probable that construction of several more gasoline plants will be authorized within the year.

● **Jerry Luboviski**, former city editor of the *Los Angeles Daily News* and the *San Diego Daily Journal*, has been appointed public relations representative of the Western Oil and Gas Association. Headquarters are in Los Angeles. The association represents approximately 90 per cent of the oil industry on the west coast.

For two years prior to taking over the city desk on the *Journal* and then the *Daily News*, Luboviski was assistant director of public relations for North American Aviation, Inc. He also was with the *United Press*, working in the Los Angeles bureau, and worked for the *Los Angeles Examiner*.

● **A. C. Andrews** has been named field project engineer and will supervise the construction of Stanolind Oil and Gas Company's Burnell-North Pettus cycling plant at Pettus, Texas, J. H. Forrester, manager of Stanolind's manufaeturing department, has announced.

C. W. Ward replaces Andrews as plant superintendent of the company's Hastings natural gasoline plant at Alvin, Texas. Ward was formerly operating engineer at the Hastings plant.

● **C. E. Finney, Jr.**, has been advanced to the presidency of the Salt Lake Refining Company and the Salt Lake Pipe Line Company, subsidiaries of Standard of California, it is announced by T. S. Peterson, president of Standard. Finney has been a vice president of Standard.

C. E. Finney, Jr.

In his new position, Finney will direct the construction and operation of both projects. Each will cost approximately $5,000,000 and they are scheduled to be completed and in operation by November 1, 1948.

Finney was graduated from Cornell University in 1912 and joined Standard in 1919, after active overseas army service. He held a series of positions of increasing importance at the Richmond Refinery, becoming assistant superintendent in 1928 and later manager of pressure distillation.

In 1931 he was named manager of the subsidiary Pasotex Refinery at El Paso, Texas, and the following year returned to Richmond as manager of the refinery. He was made assistant to the general manager of the manufacturing department in the home office in 1937 and general manager in 1943. He became a vice president in 1946.

● **H. F. Schwarting** has been appointed assistant district manager of the American Car and Foundry Company's Madison, Illinois, plant. He had previously been general electrical engineer with headquarters at ACF St. Louis plant.

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When Naylor introduced light-weight pipe with standard weight ends more than 20 years ago, the combination made it practical for oil men to use light-weight pipe on applications where heavy-wall pipe had previously been used. The resulting economies in simplified handling and assembly have made the distinctive Naylor spiral a familiar sight in the industry.

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● **Charles H. Harris** has been named manager of the new Decatur, Illinois, works of the General Electric Plastics Division. Harris, who has been assistant to the manager of the plant as well as works accountant, joined General Electric in 1930, shortly after his graduation from Washburn College. He joined the Plastics Division in 1934 after completing the company's business training course at Schenectady and various assignments in the general office accounting division there.

● **Robert J. Beams** has recently opened offices at 710 Leonhardt Building in Oklahoma City, Oklahoma, as a consulting geologist and petroleum engineer. He graduated from the University of Oklahoma in 1941, and has been employed since then by Shell Oil Company as a trainee engineer, exploitation engineer, and production geologist in Oklahoma, Kansas, North Texas, and Illinois.

R. J. Beams

Beams obtained practical experience in cable tool and rotary drilling operations in the KMA and other oil fields from North Texas to Corpus Christi during summer vacations while attending the University. His work for Shell included valuation of oil properties and interpretation of core analyses, electric logs, and other subsurface data.

● **Robert A. Feagan** has been made process engineering supervisor in the manufacturing department, Tulsa general office, of Stanolind Oil and Gas Company. He was formerly a mechanical engineering group leader. **D. W. Farnham** has been made project engineer; he was formerly a mechanical engineering group leader. **Henry K. Boswell, Loren L. Buck, Ernest O. Patterson,** and **Richard E. Pearson** have been made mechanical engineering group leaders. **Alexander Clark, Jr.,** sales engineer, has been transferred from Houston, Texas, to Tulsa. **O. W. Anderson,** seismograph interpreter, has been promoted from the division office in Houston, Texas, to the Tulsa general office as seismograph technician to do special geophysical studies. **J. R. Foster** has been made seismograph interpreter in the division office at Fort Worth, Texas. He was formerly a seismograph party chief. **W. J. Lang,** a geological scout at Wichita Falls, Texas, has been promoted to geologist in the Fort Worth office. **H. R. DeVinna,** formerly a computer, has been made assistant party chief of a three-crew deep water seismograph party in the Gulf Coast area. **L. O. Speer** has been made production foreman at Hendrick, Texas, where he was formerly farm boss. **P. D. Lenseig,** formerly head roustabout at Hugoton, Kansas, has been promoted to farm boss at Hugoton. **G. H. Lancaster,** petroleum engineer, has been transferred from Midwest, Wyoming, to Rangely, Colorado.

● **J. W. Brown** has been named manager of Oil Well Supply Company's store at Bakersfield, California, it is announced by Warner F. Parker, manager of this U. S. Steel subsidiary's California division. A native of Hamlin, Texas, where he attended high school, Brown served with the Army Air Forces in World War II. He has been a storeman in the Bakersfield store since joining "Oilwell" in August, 1947.

● **C. J. Tighe** has joined Stanolind Oil and Gas Company as field project engineer in charge of the construction of the Stanolind gasoline plant near Ulysses, Kansas, J. H. Forrester, manager of Stanolind's manufacturing department, has announced.

Stanolind announced January 6, that the Stanco plant would be constructed, with completion expected this fall. The plant is designed to process 100,000,000 cu ft a day of gas with a peak capacity of 150,000,000 cu ft a day.

Approximately 27,000 gal of natural gasoline and 37,000 gal of butane and propane will be produced daily. Residue gas will be sold to Cities Service Gas Company.

E. M. Weaver

● **Earl M. Weaver** has joined the firm of Herb J. Hawthorne, Inc., manufacturer of replaceable blade geophyical drill bits. Weaver was formerly chief engineer of Gray Tool Company, Houston, Texas.

● **Fred A. Menken,** manager of the geological department, Western Division, Tide Water Associated Oil Company, announces the promotions and new appointments of four of the company's geologists.

Claude E. Leach, a graduate of Stanford University, was named senior district geologist and assistant to the manager of the department. Leach will have his headquarters in Los Angeles.

A. S. Holston has been appointed the assistant senior geologist, and will also be in the Los Angeles offices. Holston completed his geology study at Stanford in 1922.

Appointed district geologist of the San Joaquin division was **William D. Cortright,** an employe of Associated since 1927. He will now be at Bakersfield, California. Cortright graduated from the University of California in 1924.

The fourth new appointment was **Harry M. Whaley,** graduate of the University of California and UCLA. Whaley will have offices at Santa Maria, California.

● **Arnold V. Stubenrauch** has been made a special assistant to **William D. Mason,** director in charge of Sun Oil Company's industrial relations department. Simultaneously, the appointment of **Walther F. Schneider** to succeed Stubenrauch as manager of the systems and planning department was announced by Donald P. Jones, comptroller.

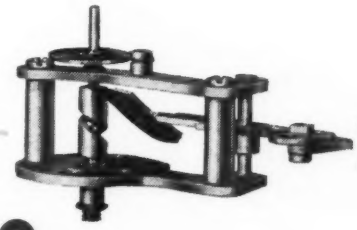
When ordinary pressure gages are used on corrosive sour oil or gas, they last only 5 to 6 weeks. That's what one company* found. Then they tried Helicoid gages with K-Monel tubes.

After 55 weeks, they were removed for inspection. There were no signs of corrosion. The gages tested accurate and were put back in service.

This is a typical case proving how money is saved by using Helicoid Gages. There are countless other examples.

For better gage value for any kind of service, insist on Helicoid—the gage of enduring accuracy.

*Name on request



Only Helicoid Pressure Gages have the Helicoid Movement

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● **A. G. Schei,** assistant treasurer of Shell Oil Company, Inc., with the firm since 1924, becomes treasurer of Shell Chemical Corporation, succeeding **J. W. Watson,** vice president and treasurer, upon his retirement September 30.

C. C. Combs, who has been assistant secretary and assistant treasurer of Shell Union Oil Corporation in New York, will return to San Francisco to replace Schei. Combs is a former West Coast executive of the firm, having worked in the Pacific Coast territory from 1923 until 1940.

R. B. Harbottle, former manager of the economics and statistics department, was appointed general auditor, effective April 1, to replace J. O'Brien who retired after 29 years with Shell.

These changes were all in the Pacific Coast territory of Shell.

● **David D. Moore,** chemical engineer, has joined the staff of Battelle Institute, Columbus, Ohio, where he will be engaged in research in engineering-economics. Moore has had eight years' experience in the petroleum industry and served four years as an officer in the Army. He is a graduate of the University of Missouri and also studied at the Missouri School of Mines. He is a member of the American Chemical Society.

● **Dr. Claude C. Peavy,** who for several years has been chief engineer for Houdry Process Corporation, Philadelphia, Pennsylvania, has been elected vice president in charge of sales and engineering, Brig. Gen. David N. Hauseman, president, has announced. Dr. Peavy has had many years' experience in all phases of petroleum refining and engineering, including catalytic cracking. He joined Houdry from Socony-Vacuum Oil Company's refining engineering division where he was chief process engineer. Prior to his five years' service with Socony-Vacuum, he had been an engineer with the E. B. Badger and Sons Company for nine years. During his service with the Badger company he worked on the design of the first commercial Houdry fixed-bed units and also saw engineering service in foreign countries.

● **Rodney S. Durkee,** president of Lane-Wells Company, has been elected president of Western Personnel Service of Pasadena, California. Durkee has been vice president for the last five years of this non-profit research institute, which supplies personnel guidance to 30 western universities and colleges. The institute provides a link between western industry and colleges.

● **E. C. Lanno,** formerly of the Detroit Diesel Engine Division of General Motors Corporation, has been named development engineer of the Rockford Clutch Division of Borg-Warner Corporation.

Lanno is a graduate engineer with several years' practical experience in the development of clutches, power takeoff, and gear reduction units, and in the industrial field. He will replace **L. F. Mohns,** resigned.

● **Thomas T. Parker,** pressed metal manufacturing engineer, has assumed his new post in that capacity at the Portland plant of the Hyster Company, manufacturers of lift and straddle trucks and tractor-mounted construction equipment. Parker has been assistant to the superintendent at the By-Products Steel Corporation, a subsidiary of Lukens Steel Company, Coatesville, Pennsylvania.

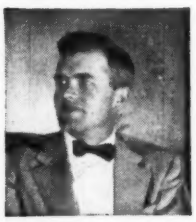
● **G. I. Lynch,** Lee C. Moore Corporation's export manager, and **R. D. Woods,** superintendent of the Tulsa plant, left the United States recently for an extended business trip through Venezula and Peru.

They will visit a number of oil companies now using Lee C. Moore equipment. Woods will remain in South America for some time to serve as an adviser on the use of Moore products.

● **E. J. Yocom** has been appointed plant superintendent of Stanolind Oil and Gas Company's cycling plant at South Jennings, Louisiana. Yocom had previously been plant foreman at this plant.

● **Paul L. Lyons** has been promoted to the newly created position of manager of the land department of Warren Oil Corporation, according to announcement by D. L. Connelly, president. He has been connected with the Warren organization for three years, and will make his headquarters in Houston. Lyons entered the oil industry in January, 1921, when he became a scout for the Sinclair Oil and Gas Company.

● **Thomas B. Kennedy** has been appointed sales and service engineer of Fluid Packed Pump Company, for Pennsylvania and New York. Kennedy, a trained engineer and graduate of Princeton University, brings nine years production experience to his new position. Beginning in 1939 in West Texas, he has served in various capacities from roustabout to production superintendent. For the last six years he has been in Pennsylvania oil fields.



T. B. Kennedy

● **E. Hastings Ackley** and **H. Louis Nichols** have announced their association for the general practice of law in Dallas, Texas. Ackley for several years was with Otis Pressure Control, Inc., handling patent matters.

● **V. C. Richards** has been appointed manager of Oil Well Supply Company's Artesia, Colorado, store, it has been announced by R. L. Armstrong, manager of this U. S. Steel subsidiary's Rocky Mountain Division. He succeeds **A. P. Wells** who has become a field representative in the Artesia area.

Richards has been a storeman in the Artesia store since joining "Oilwell" in September, 1947. Wells, who became connected with the company in July, 1944, was in Illinois until coming to the Artesia store in October, 1946.

More Value Per Inch In LUFKIN "ANCHOR"

You get years and years of measuring accuracy and satisfaction when you buy a Lufkin "Anchor" Chrome Clad Steel Tape. The line is covered with rust-resistant chrome that will not crack, chip, or peel. Easy-to-read jet black markings are permanent—they won't wear off. Genuine leather case. Get the best—order the Lufkin "Anchor" through your supply house. Write for catalog.

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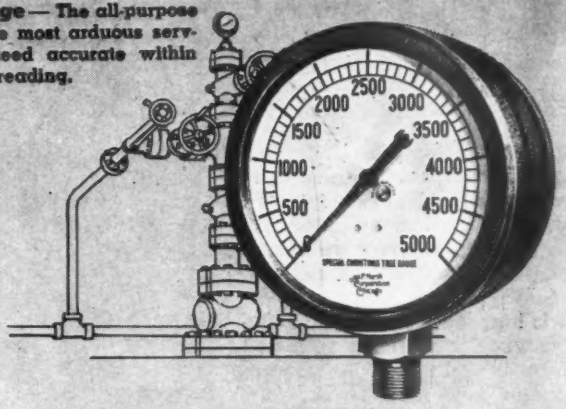
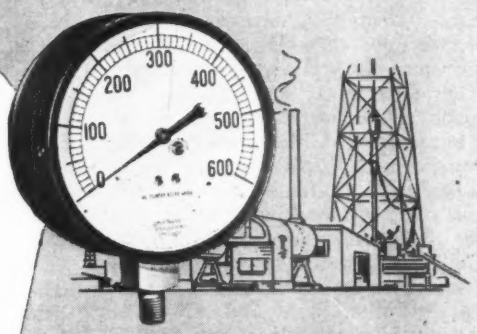


Christmas Tree Gauge — Specially made for Christmas trees. These gauges incorporate ruggedness and accuracy beyond all others.



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Because it is the greatest proving ground for gauge quality, we have met its challenge with Marsh Gauges that represent the best of all we have learned in more than 80 years of instrument making. Through construction like rugged lathe-turned Bourdon tubes, sturdy precision movements, vapor- and moisture-proof cases, we have fulfilled the needs of the industry and won the confidence of men in every branch of it. Plain proof of this is the unprecedented growth of Marsh sales wherever there is oil!

Illustrated here are Marsh Gauges used throughout the industry. Ask for handy new oil industry bulletin. (See Marsh pages in Composite Catalog.)

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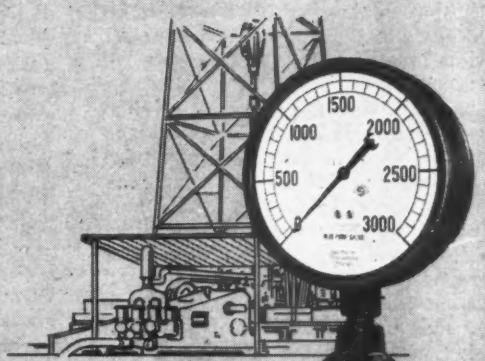
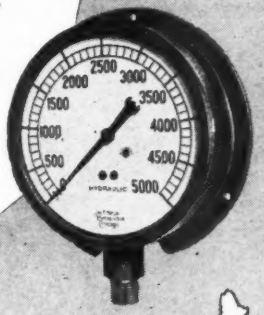


Mud Pump Gauge — The Mastergauge with protecting diaphragm of advanced design.



Hydraulic Gauge — Finest of hydraulic gauges in pressure ranges up to 30,000 lbs. per sq. in.

The Marsh branch plant at Houston offers shipment from stock and facilities for repairing all makes of gauges.

MARSH GAUGES

M. O. Johnston firm celebrates 20th anniversary

Not too long ago for present day operators to remember, the bringing in of a rotary well was less an exact scientific process than a hazardous adventure. In fact, the operator was never quite sure until casing had been set and the zone swabbed in whether he had a well or not. That is how it was when the Johnston brothers became involved in the oil well business back in 1927. There were seven Johnston boys all told, everyone of them oil men—almost from birth, and they saw the need for some more economical means of determining when the drill has really tapped a producing horizon.

Between them they developed an ingenious device — the Johnston Formation Tester—that almost immediately took the uncertainty out of that final approach. According to the record, the first practical use of this formation tester took place in Arkansas in May, 1928, and so today M. O. Johnston and all his associates are with real justification celebrating their 20th year of successful operation. The Johnston services have in that time become available to all sections of the United States and, indeed, to all parts of the world, through its several integrated organizations in Los Angeles, California, and Houston, Texas. Indicative of the progressive character of the institution is the fact that a plane is maintained by the companies to expedite service functions and to take care of emergencies.

The formation tester in its original form was devised by E. C. Johnston in 1926, and when he became pretty thoroughly satisfied that he had something of consequence, he took it to Alabama to show to M. O., who was there drilling a series of wells on contract. The latter approved the idea enthusiastically, and a testing tool was built from the drawings. This had its initial run in an El Dorado wildcat, in the presence of Pop Joiner, and it worked satisfactorily—under the conditions of the test.

M. O. wasn't altogether satisfied, however, and after giving the device a good tryout himself in the field, suggested the first significant change. That was the introduction of a trip valve that was unaffected by any movement of the drill pipe—perpendicular, horizontal, or rotary. It could be opened only after the instrument was properly seated, by the impact of a go-devil, dropped inside the pipe from the surface. Another later change was the development of a valve to equalize the pressure above and below the packer during the lifting process, so that there would be no danger in removing the packer from its seat. A third improvement was the perfection of a means of packing off against the side walls of casing.

In the beginning, the Johnston boys were simply actuated by a desire to improve their own operational efficiency.

M. O. Johnston

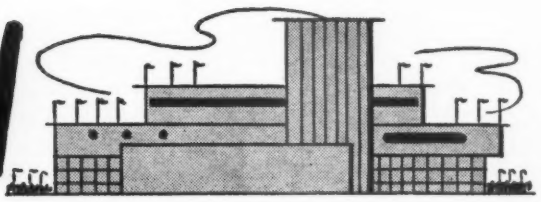
Their father was a noted water well driller of his day, and they had all naturally followed in his footsteps—merely changing the objective of the search from water to oil. The two oldest boys, Blaine and Tom, were pioneers of Spindletop, and were both working there during the time of the famous Lucas gusher, and through the years had not only infected the younger boys with their own enthusiasm for the oil business, but had also educated them with recitals of interesting petrolic adventure. By the time the formation tester idea was born, they were all men of wide experience in field work. For a time, they ran the device on their own jobs, and the results were so satisfactory that neighboring operators were continually borrowing it.

Sensing an opportunity to institute a popular type of service, E. C. went to Washington to check on the patent possibilities, and when he returned with the assurance of his attorney as to the patentability of the device, the deal was set. After the preliminary steps were taken care of, M. O. having previously made a trip to the West Coast and sensing the service possibility of the device, could no longer wait to get going. He promptly disposed of an option he was holding on some Mid-Continent oil land, and with a neat profit of $5000 in his jeans, and the distribution rights on the formation tester for the entire Pacific Coast, he hied without delay to Los Angeles. This was in 1929, and he landed in California during the worst depression in history. He found it, thus, no easy matter to sell his wares, but by dint of good hard explaining coupled with the support of the many field men and engineers who believed in the possibilities of the tester—he was able to promote enough interest to enable him to make his first test in July, 1930, for the Ohio Oil Company at McKittrick.

That was the first West Coast test and it was the beginning of success—a success that M. O. attributes greatly to the field men and operators who so conscientiously supported his initial endeavors. From that time, the organization has never ceased to move forward. During the course of the first few months in California, frequent discussions of water shut-offs stimulated M. O. to adapt his formation tester to that purpose by developing for it an effective casing packer. The first test on this was also made by Ohio Oil Company, at Venice this time, and under the observation of representatives of the State Mining Bureau. In 1931 a law was passed making it mandatory for oil operators to obtain adequate water shut-offs in all well completions. That helped greatly to attract attention to the Johnston device, but the problem of wide distribution was not really licked, until the tool proved its value in 1933 in the Belridge field,

The Johnston brothers, E. L., M. O., R. C., J. L., and E. C.

At the OIL SHOW



BE SURE TO SEE
LUNKENHEIMER VALVES

— a new line of 125 lb. S. P. Globe, Angle and Check Valves.

— recently developed lines of 125, 150 and 200 lb. S. P. Bronze Gate Valves.

— recently developed line of Bronze Globe and Angle Valves with 500 Brinell type stainless steel plug seats and discs.

— a complete line of bronze, iron, steel and corrosion-resistant valves, boiler mountings, air devices, lubricating devices, cocks, whistles, etc.

Matching the progress of the petroleum industry, the Lunkenheimer display at the first post-war exposition will feature valves and other fittings which demonstrate Lunkenheimer progress over the past several years.

In attendance to greet you at the Lunkenheimer Booths, Nos. 67-68 Oklahoma Building will be:

H. E. LUNKEN, Vice-Pres. and Ass't Gen. Mgr.
HARRY A. BURDORF, Vice-Pres.—Sales
HAROLD H. LAYRITZ, Ass't Sales Mgr.
F. H. HEHEMANN, Chief Engineer
WM. BRINKMAN, Eng. Dept.

J. A. BIRKHEAD, D. R. DAVIS, S. H. HILL
C. B. ROSSER, Jr., M. N. STICKEL
E. R. TIEBERMAN, JOS. WALDECK
Sales Representatives

Make Booths 67 and 68 your headquarters for information about the latest in valves . . . for longer-lasting, trouble-free service in field or refinery . . . LUNKENHEIMER VALVES.

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THE LUNKENHEIMER CO.

"QUALITY"

CINCINNATI 14, OHIO. U. S. A.

NEW YORK 13 CHICAGO 6
BOSTON 10 PHILADELPHIA 34

EXPORT DEPT. 318-322 HUDSON ST., NEW YORK 13, N. Y.

and received the unstinted praise of the operators.

While M. O. Johnston is best known for having pioneered the formation tester that bears the family name, he also takes considerable pride in the fact that he was one of the industry's earliest proponents of gun perforation. He states that when he migrated to California in 1929, he took with him a Rembert gun perforator, a mechanical 4-shot device that he had used in Arkansas, and before he relinquished it had developed an electrical firing mechanism for it. One of his more recent accomplishments is the conversion of a perforating gun into the highly efficient, hydrostatically-fired tool, now known as the Johnston Shoot-N-Test gun perforator. This is a companion tool for the formation tester, and can either be used in solo work for perforation, or can be operated with the formation tester as a unit for performing both functions simultaneously.

Johnston Formation Tester.

M. O. Johnston, as has already been indicated in these columns, is a man with a mind that is wide open for a worthwhile idea. He seems also to have that faculty of being able to weigh each suggestion in terms of its commercial feasibility and practicability. Being a man of wide and long experience in the oil fields, he knows tools and techniques. These are the capacities that are essential to successful enterprise. But they are not all—in addition, and certainly not the least important of his attributes, is an exceptional ability to surround himself with the right kind of people. Wherein we find the reason for the first 20 years of substantial contribution to the petroleum industry, and an easy assurance that the next 20 years will be no less productive.

Du Pont expansion

A $30,000,000 expansion of research facilities at the Du Pont Company's Experimental Station at Wilmington, Delaware, has been approved by the executive and finance committees and submitted for ratification to the board of directors, the company announces.

This is the biggest single laboratory project the company has ever undertaken. It will make the Wilmington Experimental Station, birthplace of nylon, neoprene, and other useful products, one of the largest research establishments in the world.

Some of the company's research organizations now located elsewhere will transfer to the new facilities.

This major addition to scientific facilities will be an important factor in a program to increase Du Pont's activities in fundamental, long-range research as well as research directed toward the development of new chemical products and processes, it is stated by Crawford H. Greenewalt, Du Pont president.

Construction plans call for ten new laboratory and semi-works buildings for long-range research and development of new chemical discoveries. Existing laboratory buildings for nylon and other products will be enlarged. There are also to be thirteen new service buildings.

The Chemical Department, which is devoted exclusively to research, will use its new facilities primarily for fundamental research with the object of discovering new scientific facts without regard to immediate commercial use.

The Engineering Department, in its new facilities, will explore advanced engineering problems to develop basic data on manufacturing and control equipment and construction materials.

New ACF division

Announcement is made by R. W. Ward, vice president in charge of production for American Car and Foundry Company, that a new division to be known as Tool and Die Control has been established with H. O. Amble in charge. Amble will make his headquarters at the ACF Berwick plant where he has been employed since 1932 as mechanical engineer.

Born in Norway and educated in the European schools of learning, Amble came to America in 1910 and immediately went to Buffalo, New York, where he trained for two years in the shops of Standard Steel Corporation. He then went to ACF Madison, Illinois, in 1912, to work as draftsman and subsequently served in many of the other ACF plants; in 1913 as tool and die estimator at St. Louis; in 1916 as shop engineer at Chicago, and later on as local engineer at the Buffalo plant.

During World War II, Amble was placed in charge of Ordnance Engineering at ACF Berwick then wholly engaged in the manufacture of armor plate, building combat tanks, and bulldozers.

Republic Supply opens Lake Charles store

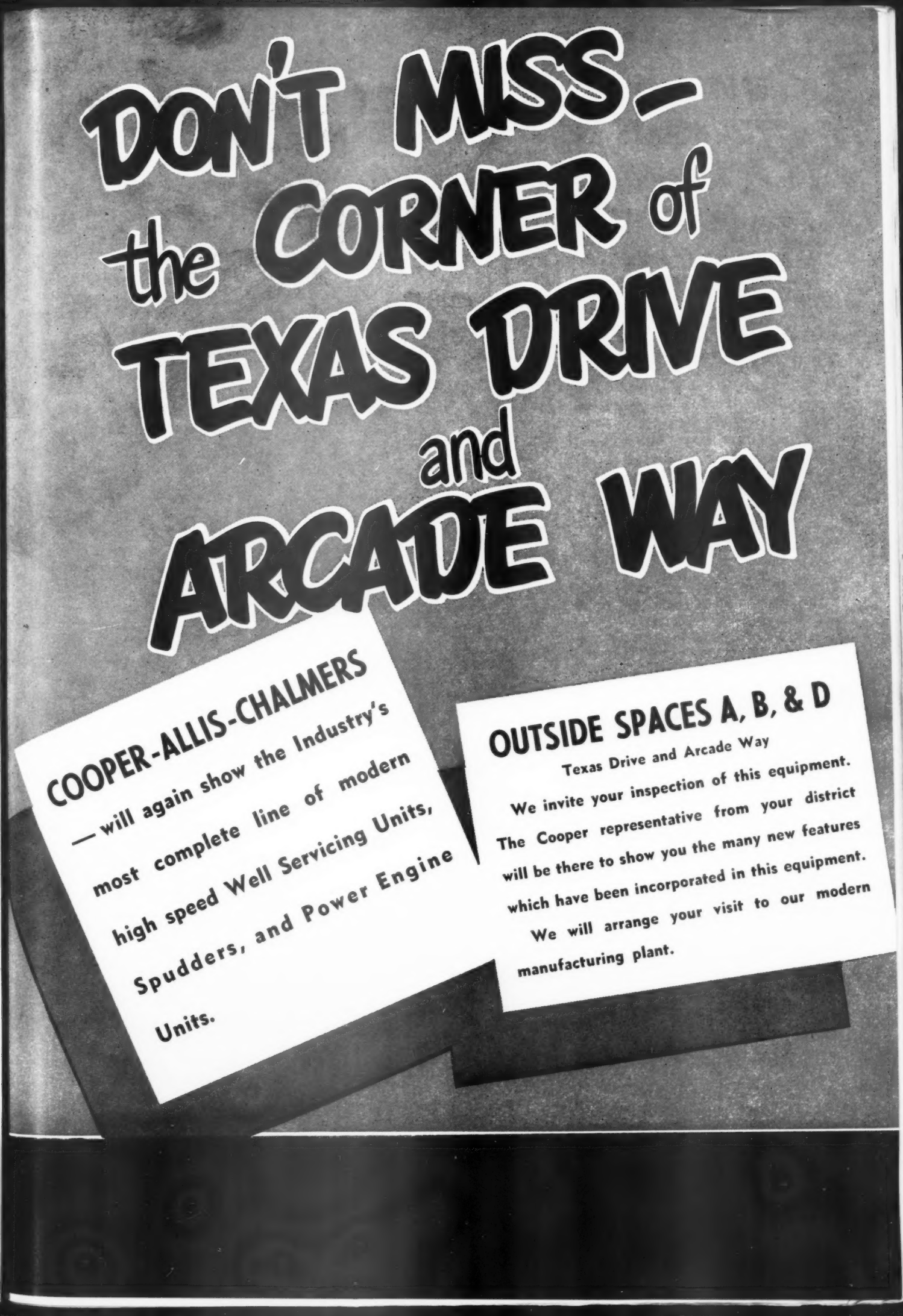
More than 500 oil men and oil equipment people, representing all phases of the industry from nearby oil fields and plants, attended the opening ceremonies of Republic Supply Company's new store in Lake Charles, April 24.

Visitors were treated to a preview of the latest innovation in oil country supply store design and arrangement. The new store is an attractive one-story structure of modern design with separate sales offices and display quarters to provide additional customer convenience. In keeping with Republic's policy, the new store has been completely stocked following a careful survey of all nearby requirements. A. M. Muterbaugh, Lake Charles engineer and contractor, supervised the construction.

Guests were served a buffet style luncheon with entertainment provided by three negro musical specialists.

Acting as hosts for the celebration were the store's personnel, including M. H. Suggs, store manager, R. R. Goforth, office manager, C. R. Smith, refinery and industrial representative, J. C. Spillar, oil field representative, and M. E. Cassidy, floorman. In addition, the following officials from Republic's general offices in Houston were present: Don Collins, executive vice president, Harry B. Catlow, vice president and manager of sales, H. C. Kinney, district manager, W. M. Haynes, manager of refinery sales, J. L. Anning, refinery sales, R. E. McCullough, purchasing agent, O. F. Adams, assistant to the sales manager, C. L. Gillespie, pipe department, and other sales representatives.

Part of the crowd attending opening of Republic's Lake Charles store.

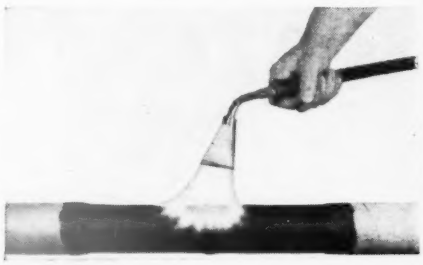

DON'T MISS—
the CORNER of
TEXAS DRIVE
and
ARCADE WAY
COOPER-ALLIS-CHALMERS
— will again show the Industry's most complete line of modern high speed Well Servicing Units, Spudders, and Power Engine Units.
OUTSIDE SPACES A, B, & D
Texas Drive and Arcade Way
We invite your inspection of this equipment. The Cooper representative from your district will be there to show you the many new features which have been incorporated in this equipment.
We will arrange your visit to our modern manufacturing plant.

It's EASY to Protect PIPE JOINTS with TAPECOAT

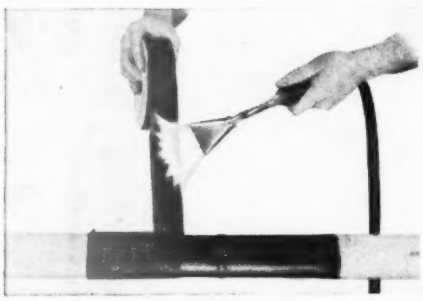
REG. TRADE MARK

Just follow three simple steps

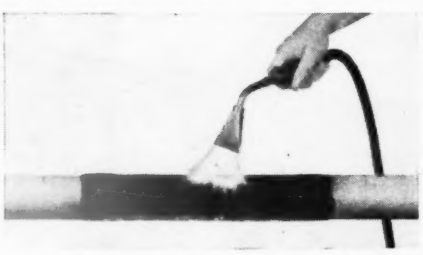
A practical, protective coating in handy tape form, TAPECOAT is easy to apply on pipe joints to give protection equivalent to the mill or machine coating on the pipe. It's clean—no dirt, no mess. Saves time and labor. Economical. Here's all you do:



STEP 1—Remove kraft paper on mill or machine coating back far enough to start one spiral wrapping of TAPECOAT over mill coating. Clean and dry bare pipe with torch as shown.



STEP 2—Start wrapping TAPECOAT where kraft paper has been removed. Flash flame of torch *lightly* on TAPECOAT to bleed its coating Secure double thickness of TAPECOAT by overlapping slightly more than half the width of the tape.



STEP 3—Finish wrapping TAPECOAT. When wrapping is completed, flash the torch flame over entire TAPECOATED section to bleed coating to a shiny surface.

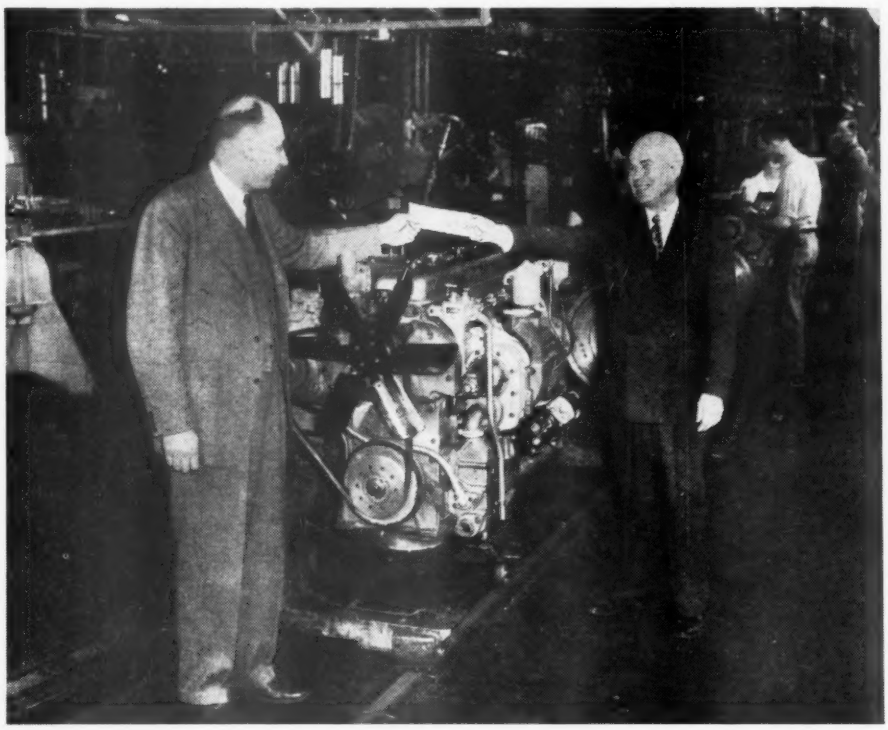
Write for complete details

The TAPECOAT Company
1523 Lyons St., Evanston, Illinois

Detroit Diesel produces 250,000th engine

An important milestone in the production and use of Diesel engines was reached on March 30 when the manufacture of the 250,000th General Motors Series 71 2-cycle diesel engine was announced by W. T. Crowe, general manager of the Detroit Diesel Engine Division.

The quarter of a million engines produced by this one factory represent an impressive total of over 40,000,00 hp; four times the total diesel horsepower that was in existence in January, 1938, when the division first began operations. The figure is estimated by engineers to be sufficient to power 190 ocean-going ships comparable to the Queen Elizabeth. Starting with only 460 employees 10 years ago, Detroit Diesel has steadily grown to an organization of several thousand highly trained men and women. In that time nearly 1,000,000 sq ft of floor space has been added to the plant's original working area of 132,000 sq ft.



George A. Zink, works manager of the Detroit Diesel Engine Division, delivering the 250,000th engine to V. C. Genn, general sales manager.

Staff enlarged

Two additions to the staff of the mechanical engineering department of the Young Radiator Company, Racine, Wisconsin, have been announced by F. M. Young, president.

Paul Mortenson, born and reared in Racine, has been assigned to the contract products division as a sales engineer. He holds a bachelor of engineering degree in mechanical engineering from the University of Southern California. Upon graduation, Mortenson continued his technical training at the Curtiss Wright Technical Institute in Glendale, California. During the war years he worked in the engineering department at Lockheed.

P. C. Mortenson

J. A. McBride

James A. McBride, industrial engineer, joins the Young organization from the Cord Corporation where he was coordinator of engineering and production, in which capacity he acted as special assistant to E. L. Cord. McBride holds a degree in mechanical engineering from Tri-State College, Angola, Indiana.

Houston branch

Moore Products Company, Philadelphia, Pennsylvania, announces the opening of a Houston branch office with Robert A. Barnes as manager. This office, at 7041 Harrisburg Boulevard, will be a sales and service center for Nullmatic industrial instruments.

Barnes brings to the Moore organization a thorough experience in instrument work. He obtained his B. S. in mechanical engineering from Purdue in 1933. After graduate work in petroleum engineering at the University of Oklahoma, he spent 11 years with a leading instrument manufacturer—as a sales engineer and as an application engineer.

Precision machine

All the way from Bienne, Switzerland, comes the Hauser Precision Jig Borer shown in the accompanying photograph being installed in the plant of Technical Oil Tool Corporation, Los Angeles. The last word in accuracy, this machine is capable of drilling holes within 40 millionths of an inch (0.000040 in.) accuracy for position—so precise that a microscopic attachment must be used!

One of the very few machines of its kind in the United States, the Hauser

will also bore holes at any angle by means of a special inclined rotary able. To keep the machine and its attachments in condition to do the precision work for which they were designed, Totco will house them in a separate temperature-controlled room.

The smiling man in the forgeround is Oswald Suter of Totco, who, incidentally, is himself a Swiss.

Into new building

Marine Exploration Company recently moved into a new exploration building at 3732 Westheimer Road, Houston, Texas, which will afford the firm much larger quarters and more extensive laboratory facilities, A. B. Hamil, president, announced.

With this move into larger quarters, Marine Exploration will increase its personnel, both in the administrative and technical branches of their work, Hamil said.

Marine Exploration Company has offices in Houston and New Orleans with field crews working throughout the oil country.

Silsbee transferred

Charles S. Silsbee, formerly manager of the Marine Division, New York office of the Dearborn Chemical Company, has been transferred to the main office, 310 South Michigan Avenue, Chicago.

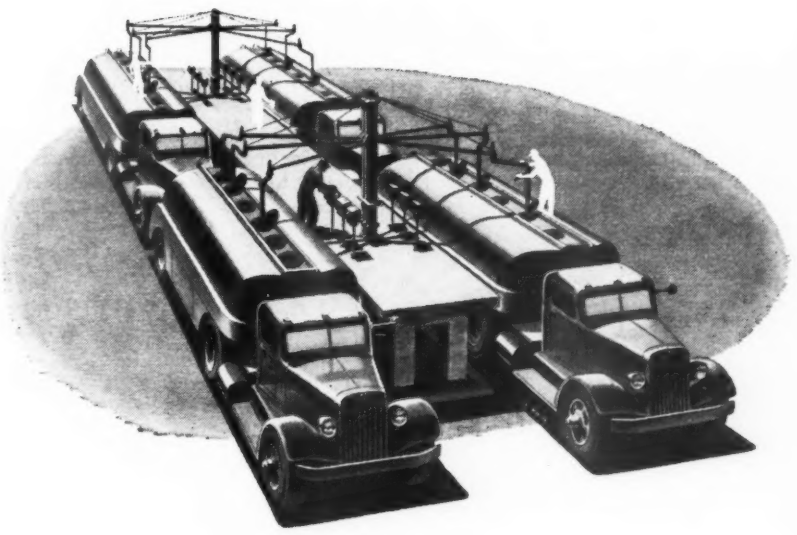
Silsbee will be assistant to E. P. Fager, vice president of the Industrial Feed Water Sales and Engineering Department.

how to be

4 PLACES AT ONCE!

* CONTROL TRUCK LOADING AT FOUR STATIONS WITH ONE ATTENDANT, THIS SAFE, FAST, TIME-SAVING WAY

When truck loading meters are equipped with SMITH AUTOMATIC SET STOP and VALVE the delivery is automatically controlled. Simply set the compartment capacity on the predetermining counter and move the control handle. The pump is started and valve opened. When delivery reaches completion the flow is slowed down, topping the compartment — valve closes on **exact** gallon and stops pump. Duplicate tickets are printed showing the exact amount delivered with product identified—your copy providing you with an infallible accounting system. May we tell you more about it?



SMITH METER COMPANY

SUBSIDIARY OF A. O. SMITH CORPORATION

FACTORY—5743 SMITHWAY, LOS ANGELES 22, CALIF.

Sales Offices: NEW YORK, CHICAGO, HOUSTON, LOS ANGELES.

In Canada; TORONTO, VANCOUVER. *International Division,* MILWAUKEE 1, WISC. *Local Agents in All Principal Cities.*

Cummins officers

Directors of Cummins Engine Company, Inc., have named three new vice presidents and one new director for the ensuing year. J. I. Miller, president of the company, announced the board action after its organization meeting held at the corporation offices in Columbus, Indiana, following the annual shareholders' meeting.

The newly elected vice presidents are L. W. Beck, vice president, sales; D. J. Cummins, vice president, engineering, and W. M. Harrison, vice president and treasurer.

Carl R. Fox

L. W. Beck

D. J. Cummins

W. M. Harrison

Carl R. Fox, who has been vice president and works manager for several years, is the newly elected director.

All other officers were re-elected as follows: C. L. Cummins, chairman of the board; J. I. Miller, president; V. E. McMullen, executive vice president; R. E. Huthsteiner, vice president and general manager; Carl R. Fox, vice president and works manager, and E. G. Crouch, secretary.

The other directors were re-elected and include Mrs. Nettie S. Miller, C. L. Cummins, H. L. Knudsen, V. E. McMullen, J. I. Miller, and R. E. Huthsteiner.

W. J. Manning was elected assistant secretary and assistant treasurer and promoted to the position of controller from his former position of assistant controller.

New sales engineers

In further expansion of its national sales organization, Federal Telephone and Radio Corporation, Clifton, New Jersey, associate of International Telephone and Telegraph Corporation, had added two sales engineers to its California staff, representing FTR's mobile radiotelephone division.

Lt. Commander R. E. Trapeur (U. S. Navy, retired), has joined Federal to act as sales representative in Northern California, following more than 30 years' service in the Navy where he was actively engaged in electronics and communications work.

Richard Reimer has also joined Federal, to represent the company's mobile radiotelephone division in Southern California. Reimer has had extensive experience in aircraft radar and radio equipment, including several years of broadcast transmitter work and VHF equipment design. He was formerly associated with the Yellow Cab Company, Los Angeles, in charge of its FM two-way mobile equipment.

Moves district office

Bethlehem Supply Company announces the moving of its West Texas and New Mexico district office from the Odessa, Texas, store to the Midland Tower Building, Room 927, at Midland, Texas.

In conjunction with this change in location of district headquarters to Midland, Texas, several changes in personnel were made.

W. A. LaRew, formerly assistant district manager at Odessa, has been promoted to district manager at Midland, Texas. "Babe" LaRew has been in engineering construction work for 21 years and has been affiliated with Bethlehem since January, 1945. He is a capable engineer and is thoroughly acquainted with the oil field supply business.

R. E. Throckmorton, Jr., formerly field representative at Midland, has been promoted to local representative and will make his headquarters in the new office at Midland.

W. A. Langbein, formerly store manager and field representative at Odessa, has been promoted to assistant manager of the West Texas and New Mexico district and will make his headquarters at the Odessa store. K. M. Cook, formerly store manager and field representative at Hobbs, New Mexico, has been transferred in the same capacity to Odessa, to replace W. A. Langbein.

Thomas Ray, Jr., formerly chief clerk in the Central Oklahoma district office, has been promoted to field representative in the Oklahoma City store.

R. E. Garner, Jr., formerly field representative at Hobbs, New Mexico, has been promoted to store manager and field representative replacing K. M. Cook.

Firm name changed

The name of The American Rolling Mill Company was officially changed to Armco Steel Corporation at the annual meeting of stockholders, Charles R. Hook, president, announced. William C. Breed, Edward A. Deeds, Charles S. Payson, and Calvin Verity were reelected directors of the company.

"It is a clear cut example of the power of advertising," Hook declared. "Our trade name 'Armco' has been the theme of national consumer advertising since 1914, and has been emphasized in all publicity since then. The Armco trademark has been used on our products and on many of the products of our customers. As a result, our company for many years as been best known as Armco."

Announces distributor

The Hall-Scott Motor Division of ACF-Brill Motors Company announces the appointment of Great Lakes Auto Parts and Machine Works, Inc., Duluth, Minnesota, as distributor for Hall-Scott truck, industrial and marine engines, parts and service for the states of Minnesota, northern Wisconsin, and northern Michigan.

New officers for American Petroleum Institute Southwestern District

Officers API Southwestern District. Left to right: L. H. Dial, East Texas Salt Water Disposal Company, Kilgore, Texas, vice chairman for East Texas; O. W. Van Dyke, Magnet Cove Barium Corporation, Houston, Texas, secretary-treasurer; R. E. Bridges, Humble Oil and Refining Company, Houston, Texas, chairman; B. J. Dowd, Union Producing Company, Shreveport, Louisiana, chairman advisory committee; R. B. Saxe, Gulf Oil Corporation, Odessa, Texas, vice chairman for West Texas.

Star Performers

ON RIGS THE WORLD OVER

For over twenty years Foster Catheads have been used on rigs the world over and their records of speed, safety and dependability have become standards of cathead performance.

For the utmost in cathead performance... for quicker trips in and out... equip your rigs with Foster Catheads.

FOSTER SPINNING CATHEAD

Relieves operator of handling spinning line . . . line stops automatically and instantaneously when handle is released . . . pipe is spun smoothly under low clutch pressures . . . plenty of power for tonging . . . friction material is treated for heat resistance . . . drum does not crawl when clutch is disengaged.

FOSTER MASTER BREAKOUT CATHEAD

Driller is in constant control of power applied to jerkline . . . slower jerkline speeds used . . . no positive clutch to accidentally engage . . . friction clutch and small drum permit instant engagement without reducing lineshaft speed . . . no metal-to-metal impact . . . no brakes required . . . equipped with air or manual controls.

SEE THESE CATHEADS AT THE TULSA OIL SHOW
... BOOTHS 12 AND 13 ... TEXAS BUILDING

FOSTER CATHEAD COMPANY

P. O. BOX 1675 — WICHITA FALLS, TEXAS

FACTORY REPRESENTATIVES:

Lloyd Hopeman	Tillery & Parks	Nicholas A. D'Arcy	Allen C. Evans
Seminole, Okla.	Odessa, Texas	Huntington Park, Cal.	Houston, Texas

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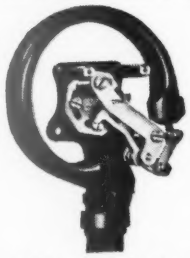

20% to 30% Longer *Bourdon* Tubes

Bourdon tubes in the ACRAGAGE are 20% to 30% longer than average . . . resulting in the following advantages: less strain per unit length on the spring; increased durability; longer fatigue life; heavier wall thickness for added safety; greater tip-travel — providing sustained accuracies to within one-half of one percent!

Remember ACRAGAGE — a quality product made by skilled craftsmen from materials which meet rigid standards, including Army and Navy specifications.

WRITE for folder on SPECIAL TYPE 316 PETROLEUM GAGE

CLAPP INSTRUMENT CO.

Acragage

WEBSTER, MASS.

Republic Supply sold

Republic Supply Company, prominent in oil country supply circles since 1910, has been sold by Republic Steel Corporation, Cleveland, Ohio, the parent firm, to a group of individual investors. Purchasers are former Governor Robert S. Kerr, D. A. McGee and Associates of Oklahoma City. The latter interest owns and operates the Murray Tool and Supply Company in Oklahoma with stores in Oklahoma City, Elmore City, and Pawhuska. A manufacturing plant is maintained at Pawhuska. The three Murray stores will be added to Republic's 51 sales and service points. Sale price has not been revealed.

A. B. Judd, for many years vice president and general manager of Republic Supply Company, continues with the firm and becomes president. Don Collins, Oklahoma City, president of Murray Tool and Supply Company, has been made executive vice president of the new organization, and H. B. Catlow becomes vice president and manager of sales. Collins will move to Houston in the near future where he will maintain headquarters. John H. Lollar, Jr., Republic secretary and treasurer, continues in the same capacity. The company will operate under the name of Republic Supply Company and headquarters will remain in Houston.

Founded in 1910 with one location in Port Arthur, Texas, Republic Supply has grown with the rapidly expanding oil industry until today it operates sales offices and stores in the nine states of Arkansas, Colorado, Illinois, Kansas, Louisiana, Mississippi, New Mexico, Oklahoma, and Texas.

With the exception now of the specialties produced by the Murray Tool and Supply Company, Republic manufactures no products of its own and serves exclusively as a supply outlet for the products of more than 200 leading manufacturers. These products include a complete line of drilling machinery, der-

A. B. Judd

Don Collins

H. B. Catlow

J. H. Lollar, Jr.

ricks, sub-structures, gas, gasoline and diesel engines, pipe line equipment, surface and sub-surface pumping equipment, valves, fittings, and refining and chemical plant equipment. The company's new central warehouse and store in Houston occupies a site of 13 acres and has more than 100,000 sq ft of display and storage space. This modern warehouse facility, in addition to serving the Houston territory, acts as a general supply depot for all field stores.

President Judd announces that the change in ownership will not affect the long established policies and services of the company, which have been designed to provide the petroleum and chemical industries with a complete service in keeping with current and future operating requirements.

A get-together meeting of the new owners and executives with 50 of the company's key personnel and their wives was held in Galveston during the weekend of April 25.

Unibolt sales manager

Thornhill-Craver Company, Houston, Texas, manufacturers of Unibolt products, has announced the promotion of Jack Skeehan from sales representative to sales manager. Skeehan has been a member of the Unibolt sales staff since 1946, when he resigned his position with National Supply Company in Houston to accept a position with Thornhill-Craver in California.

Jack Skeehan

A graduate of Notre Dame, Skeehan's first work was with Spang-Chalfant at its Ambridge, Pennsylvania, mill. He served that company as field representative in the Southwest and did sales and engineering work in California, later being transferred to Houston to work as pipe salesman for National. During the war he was recalled to Pittsburgh by Spang-Chalfant to serve as assistant supervisor of industrial relations, and returned to Houston for National in 1944, which position he resigned to go with Thornhill-Craver Company.

Skeehan has moved his family to Houston, his headquarters.

Section recognized

The North Texas Section was given official recognition by the National Association of Corrosion Engineers at a meeting in Fort Worth April 29. At that time, also, permanent officers of the Section were elected. They are: Tom D. Statham, Magnolia Petroleum Company, Dallas, chairman; James A. Clay, Jr., Service Engineers, Inc., Fort Worth, vice chairman; C. I. Sims, consulting engineer, Dallas, secretary-treasurer, and L. C. Starbird, Southwestern Bell Telephone Company, Dallas, assistant secretary.

The next meeting will be held in Dallas on May 27. Cocktail hour will be at 6:30 with dinner following. The place is 1515½ Commerce at the Reserve Officers Club. Guest speaker will be Ed Doremus, Cathodic Protection Service, Houston.

Meter meetings

"Regulated Control of Gases and Liquids" will be the subject of a talk by James Gesner, of the Reliance Regulator Corporation, at the next meeting of the Southern California Meter Association, to be held at the Rio Hondo Country Club, May 20, with dinner at 6:00 p. m.

As a second feature of the program, Edward Niederer, division engineer of the Southern Counties Gas Company, will discuss "Unitary Gas Regulation," a new approach to the problem of control.

White TRANSITS · LEVELS · ALIDADES WITH COATED OPTICS

...For greater Accuracy and all-around Dependability

The recognition accorded White instruments is world-wide — a tribute to the accuracy and dependability for which they have long been famous. Write today for detailed literature and price data.

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We repair all makes of instruments

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Illustrated, famous Type II Transit

Want Safe, Easy Pulling?

There's a COFFING SAFETY-PULL HOIST (RATCHET LEVER TYPE) FOR EVERY JOB

You'll get more work done—faster and with greater safety—when you use a Coffing Safety-Pull Ratchet Lever Hoist for lifting, pulling or load binding. The Safety-Pull is simple in design and extremely easy to operate—yet durable and rugged in construction to handle heavy duty jobs day after day. Choose the hoist to meet your specific needs from the nine models available—with capacities from ¾ to 15 tons! You'll be ahead on time, on manpower . . . on safety.

SEND FOR BULLETIN VRL-5

OTHER COFFING PRODUCTS — Electric Hoists • Differential Hoists • Hoist-Jacks • "Mighty-Midget" Puller • Spur-Geared Hoists • Load Binders • Trolleys.

Safety-Pull Hoist raises suction hose in drilling operation

Why COFFING Is the Better Hoist

- Hooks of drop forged, heat treated steel.
- Dual ratchet and pawl assembly for maximum safety.
- Replaceable "Safety-load" handle will bend before any other part of the hoist gives.
- Handle is reversible—Hoist operates in any position.
- Every model factory tested to 100% over rated capacity.

COFFING

THE COFFING HOIST COMPANY

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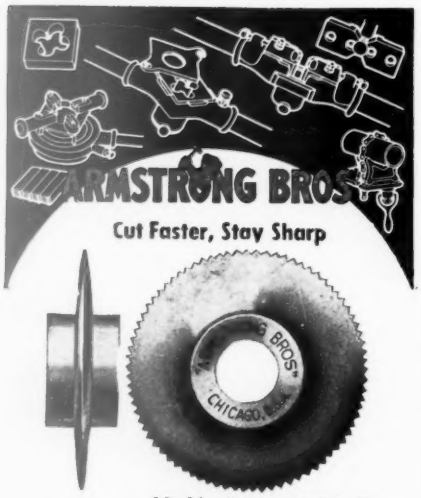

Machined from special alloy tool steel, oil tempered and hardened, ARMSTRONG BROS. Knife Blade Cutter Wheels penetrate pipe easily, cut smoothly and rapidly, and hold their keen edge. They come in sizes and types for all makes of pipe cutters, and are stocked by leading tool departments everywhere.

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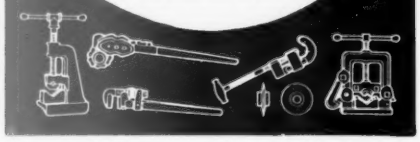

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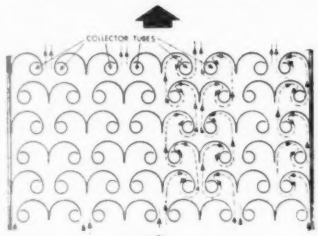

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New baffle principle completely knocks out *all* liquid and mist from *any gas or steam.* Exceptionally *high capacity.* Write for complete, descriptive MIS-D-FIER Bulletin.

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LONG BEACH 7, CALIF.

Tulsa firm designs pump

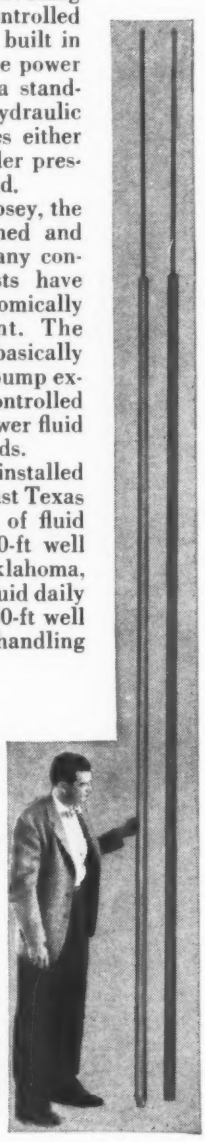
A new million dollar corporation in Tulsa, Oklahoma, for the manufacture of a new type hydraulic-operated bottom hole pump has been announced by Oscar E. Dempsey, pioneer Tulsa pipe line contractor.

The new pump, designed by Dempsey and Charles L. English, vice president of the new Dempsey Pump Company, is a hydraulically operated bottom hole type, consisting of an engine and actuated with fluid connected through a packing arrangement to a standard pump piston and traveling valve. The action is controlled by a three-way valve built in the engine piston. The power fluid is supplied by a standard high pressure hydraulic surface unit that uses either oil, water, or gas under pressure as operating fluid.

According to Dempsey, the new pump is designed and manufactured to fit any condition and field tests have proved it to be economically simple and efficient. The pumping action is basically that of a sucker rod pump except the stroke is controlled and the hydraulic power fluid eliminates sucker rods.

One of the pumps installed in a 3200-ft well in East Texas is handling 250 bbl of fluid daily. One in a 3000-ft well near Holdenville, Oklahoma, is lifting 240 bbl of fluid daily and another in a 7000-ft well on the Gulf Coast is handling 200 bbl daily.

The new firm has purchased the large factory building at 2440 East King Street in Tulsa, where they will manufacture the new pumps and the Rotaram. Specialty Sales and Service, Inc., of Tulsa will distribute the Dempsey pumps.



Leslie Wallraven of Specialty Sales and Service, Inc., inspects Dempsey bottom hole pump.

Sales representatives

Three new regional field representatives have been appointed by Burgess-Manning Company to aid Burgess Snubber users in their respective territories. This increased representation is located on the Pacific Coast, to make Burgess-Manning services more available to diesel engine manufacturers and operators in that area.

Two companies, the H. G. McLaughlin Company, Inc., and The Merrill Company, were associated with Burgess-Manning before the war. The H. G. McLaughlin Company is in Seattle, Washington, and sales will be handled by C. H. Floyd, president, and Cecil R. Hull.

W. H. Edis, George Brose, and Jack Geanes of the Merrill Company will handle sales for Burgess-Manning in the San Francisco territory.

Clark E. Rucker and Herb Vickery of The Rucker Company, Oakland, California, represent Burgess-Manning in the Los Angeles area.

To Houston area

Byron Jackson Company, Oil Tool Division, announces the assignment of Robert V. Wildman to the Houston area. Wildman's assignments will include export contacts as well as East Texas Gulf Coast and East Texas operating territories.

R. V. Wildman

With varied experience as roughneck and supply salesman in California, Wildman joined BJ in 1947 and completed his shop and field training in March of this year.

Wildman will operate out of the Houston office under C. F. "Bud" Vincent.

Chicago district manager

Appointment of George R. Frankland as Chicago district manager, Johns-Manville Industrial Products Division, is announced by C. G. Dandrow, vice president and general sales manager.

Frankland succeeds Corydon H. Hall, who resigned April 1, to become president and chief executive officer of a new company being organized in California.

William S. Hough, formerly manager of the chemical and aviation sections of the company's special industries department at New York, will assume Frankland's former duties in Chicago as assistant district manager, Industrial Products Division.

Frankland brings a broad background of 15 years as assistant district manager at Chicago to his new post. In the past he has held many positions of responsibility in the field of marketing industrial products.

In additon to his experience as a sales manager in the chemical and aviation fields, Hough served in many other sales capacities during 22 years with Johns-Manville in New York and Newark, New Jersey, where he made his headquarters for nearly 10 years.

Expands activities

The Layne - Texas Company, Ltd., Houston and Dallas, Texas, is expanding its activities in the water field to include the sale and application of water treatment equipment in the municipal and industrial spheres. This division will be in charge of A. J. Krell who formerly represented General Filter and Kinney Engineers in this area. Krell, prior to this was a group leader in charge of industrial waste research for the National Aniline Division of Allied Dye and Chemical Corporation, Buffalo, New York.

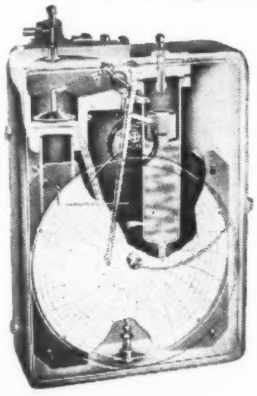
SIMPLIFIED DESIGN FOR ACCURATE LOW-COST OPERATION

As petroleum refining progressed from straight run processes through all the intricacies of modern refining methods METRIC American Orifice Meters have kept pace. They meet—and in many cases exceed—demands for accuracy and low-cost operation under tough conditions.

There are few moving parts, simply designed, interchangeable, easily replaced—only *one* between the surface of mercury and chart record.

Adjustment is easy—needing only screw driver, wrench and pliers. Every part is readily accessible. Cleaning does not interfere with operation.

The world over, experienced metric engineers acknowledge the ruggedness and dependability of METRIC American Meters.



Technical literature, on Indicating, Recording or Integrating Flowmeters, Pressure Regulators, Liquid Level and Flow Controllers will be mailed on request.

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HOTELS

Sales representative

L. D. McKay and Company, 207 Citizens Bank Building, Tulsa, Oklahoma, announce their appointment as Oklahoma sales representative for the Riley Stoker Corporation, Worcester, Massachusetts, covering their complete line of steam generating equipment and fuel burning equipment.

L. D. McKay

Other lines of mechanical equipment handled by this concern are the Coppus Engineering Corporation, Milton Roy Company, Farris Engineering Corporation, Helicoid Gage Division of American Chain and Cable Company, Reliance Gauge Column Company, Continental Equipment Company, and Alfred E. Evans Company.

Paul Van Valkenburgh is associated with L. D. McKay and Company as sales engineer and Myron S. Hite as resident engineer. McKay is also Tulsa district manager for the Union Steam Pump Sales Company of Battle Creek, Michigan.

New Fluor division

A new division of The Fluor Corporation, Ltd., called the Mid-Continent Gas-Gasoline Division, has been set up with offices in the M & M Building, Houston, Texas, with Ernest Moncrief manager in charge. This new division was actively engaged in its new quarters May 1.

Ernest Moncrief

The division is to handle engineering, drafting, purchasing, and accounting, together with construction, using Fluor's regular field personnel, on gas-gasoline, cycling, and dehydration plants in the area east of the Rocky Mountains.

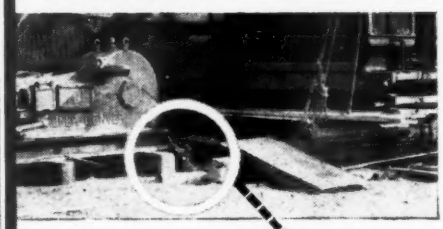
Along with Moncrief, the following Fluor personnel is being transferred to complement and integrate the functions of this new division: J. L. Tathwell, engineering department; William F. Chapin, process department; Tom H. Hanks, accounting department, and C. E. Richardson, purchasing department.

New credit manager

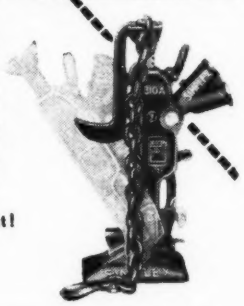
C. M. Wittum, eastern division credit manager for Oil Well Supply Company since August, 1946, has been appointed credit manager for that U. S. Steel subsidiary's Mid-Continent and Rocky Mountain divisions, it was announced by G. F. Goetzinger, treasurer. His headquarters will be at Tulsa, Oklahoma.

W. D. Bauman, who has been with "Oilwell's" eastern division credit office at Columbus, Ohio, since 1938, was named to succeed Wittum. Bauman joined "Oilwell" in 1929 in the credit department at Pittsburgh.

FOR TOUGH OIL FIELD JOBS
USE A SIMPLEX
EMERGENCY JACK MODEL 310-A



Lifts vertically, lifts or pushes at any angle!
Lifts *full 15 ton capacity* on the machine serrated toe, on the cap, on the auxiliary cap shoe or on any link of 5' chain!
Double lever socket!
14" lift!



Meets emergency jacking needs in the oil field . . . with power, safety and easy operation!

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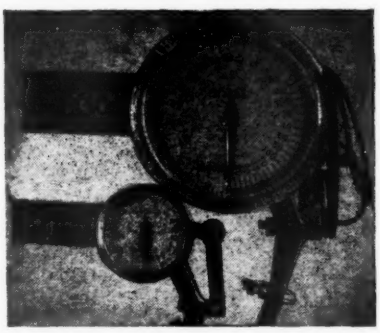
LINE SCALES



(Above) Super 500,000-lb. capacity, 14" dial. (Below) Packer Special, Capacity 40,000 lbs., 6" dial. 18 other models for every drilling, well servicing, or work-over need.

20 MODELS to choose from

With a LINE SCALE you know the pull on the line, and the weight on the bit in pounds. Repeated tests prove the accuracy and dependability of LINE SCALE readings under all working conditions . . . even in areas of rapid temperature changes.

LINE SCALE CO., Inc.
Box 4245 Oklahoma City Phone 6-1765
Gulf Coast Representative: Hiram Wheeler
Box 8043, Houston 4, Texas—JA-1107

Director National Supply

Stockholders of The National Supply Company at their annual meeting elected Carl I. Collins a director of the company for a three-year term. He succeeds T. H. McGraw, Jr., who has retired from the board. Collins is president of Superior Steel Corporation, Pittsburgh, and is also a director of American Iron and Steel Institute and of Commonwealth Trust Company of Pittsburgh.

Carl I. Collins

Henry Chalfant, Edward H. Green, and Wm. B. McFall were reelected directors for three-year terms.

Sales representative

Byron Jackson Company, Oil Tool Division, announces the assignment of Steve K. Williamson as sales representative in the Mid-Continent area. Williamson has worked in the oil fields most of his life and has recently completed an intensive sales and service training course in the oil tool plants.

S. K. Williamson

Williamson will be in charge of the Tulsa office, 314 Thompson Building, and cover the eastern Oklahoma, Kansas territories, in addition to Tulsa.

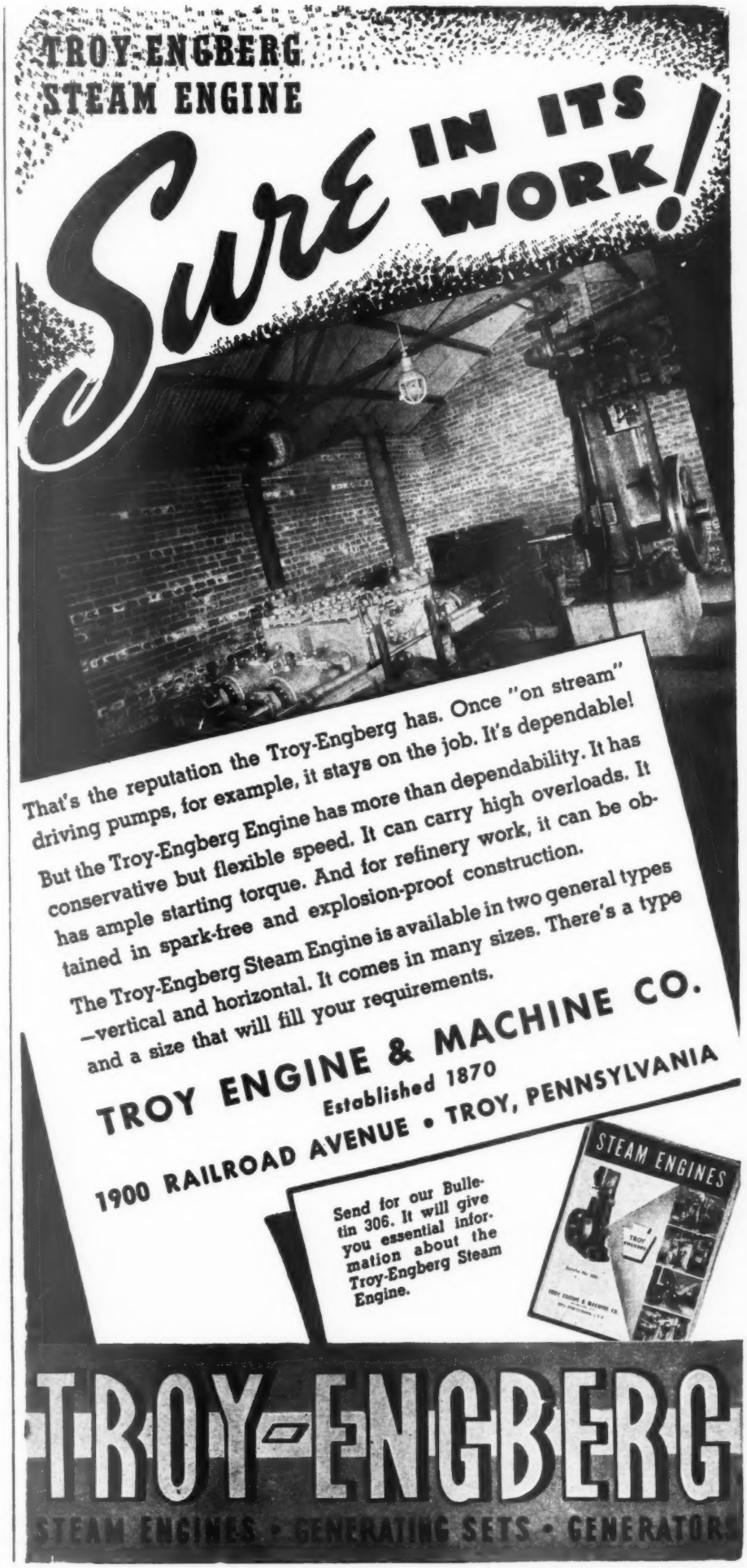
Division sales manager

Terry Russell, well known throughout the petroleum industry of Texas, Louisiana, Mid-Continent, California, and South America, has been named Texas divisional sales manager of Hammond Iron Works, whose main offices are at Warren, Pennsylvania, and Port Neches, Texas. An M. E. graduate of University of Texas, member of Houston Nomads, the API and ASME. Russell will make his headquarters at 531 Esperson Building, Houston, and at the Texas plant at Port Neches, where Hammond designs and fabricates cone roof, vaporlift, spheres, and other conservation storage tanks.

Terry Russell

To directorate

At the recent meeting of the board of directors of American Car and Foundry Company, James A. Farrell, Jr., and William F. Van Deventer were elected to the board to fill existing vacancies, it was announced by Charles J. Hardy, Jr., president.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But the Troy-Engberg Engine has more than dependability. It has conservative but flexible speed. It can carry high overloads. It has ample starting torque. And for refinery work, it can be obtained in spark-free and explosion-proof construction.
The Troy-Engberg Steam Engine is available in two general types —vertical and horizontal. It comes in many sizes. There's a type and a size that will fill your requirements.
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Send for our Bulletin 306. It will give you essential information about the Troy-Engberg Steam Engine.
STEAM ENGINES
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STEAM ENGINES • GENERATING SETS • GENERATORS

John N. Martin opens new plant in Tulsa

John N. Martin, Manufacturer, has completed a new plant at 9 West Brady Street, Tulsa, Oklahoma, which more than triples the floor space and production capacity. All equipment is of the latest type, giving maximum production efficiency.

Martin invented and began the manufacture of the Martin Plunger and Martin Rings at Tulsa in 1937, and has expanded the line to fit the hundreds of makes and sizes of pumps and well conditions. A new product, The Martin Cage, employing synthetic rubber ball guides, is now in the process of manufacture, and will be announced in the near future.

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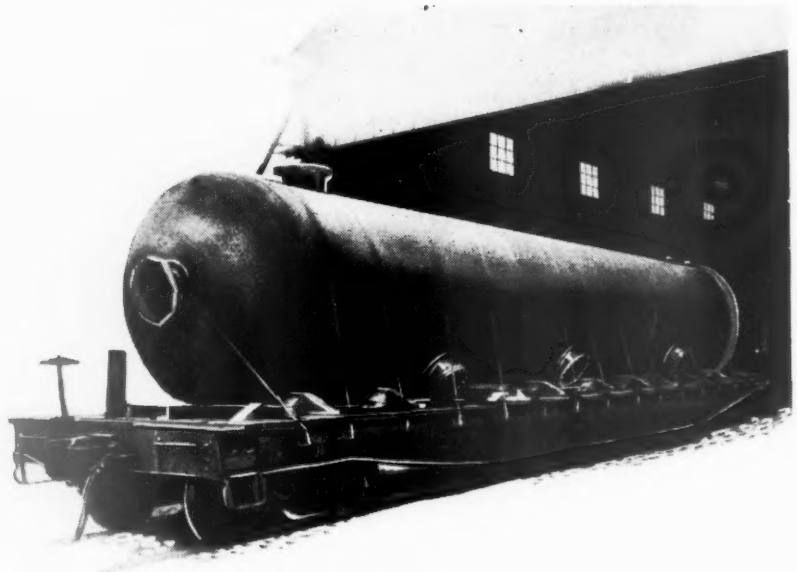

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- HEAD STOCK UP TO 10' x 600 lbs. per sq. inch W.P.
- FULL-TIME NATIONAL BOARD INSPECTION.

Send Inquiries to REFINERY EQUIPMENT DEPARTMENT
BUTANE EQUIPMENT CO., INC.
Box 9275
DALLAS, TEXAS Telephone: LD-140

Paul Pottker advanced

Appointment of Paul E. Pottker as assistant manager of sales for Oil Well Supply Company's Witte Engine Works Division at Kansas City, Missouri, was announced at Dallas by Lloyd E. Tracy, vice president, sales, for this U. S. Steel subsidiary.

P. E. Pottker

A native of Peoria, Illinois, Pottker attended the University of Illinois. He joined "Oilwell" as export manager of Witte Engine Works Division in November, 1945, remaining in that capacity until his new appointment.

London representative

F. A. Trim has been made Universal Oil Products Company's representative in London, succeeding W. A. Keightley who has returned to Chicago as a member of the commercial development department.

F. A. Trim

Trim joined Universal in 1934, and since that time has served as assistant to Dr. Victor Henny, former Universal representative, and later to Keightley.

Appointments announced

A. S. Rairden has been named wire rope sales manager for The Colorado Fuel and Iron Corporation, its subsidiaries and divisions, N. H. Orr, vice president in charge of sales, announces. He joined the Wickwire Spencer Steel Division in October, 1933, as wire rope sales engineer and became wire rope sales manager of Wickwire Spencer Steel Company prior to its merger with The Colorado Fuel and Iron Corporation. E. L. Klinger, has been appointed wire rope sales engineer, it is further announced. In his new capacity he will continue supervision of expanded sales engineering force in addition to acting as assistant to A. S. Rairden.

Petrolic Personalities

By DICK SNEDDON

These are hectic days in the oil industry! From all sections of the country come stories of fermentation and unrest, brought on by the imminence of that great International Petroleum Exposition—the Tulsa Oil Show. The exodus from California, we know, is going to be terrific. Delegates are flying back in company planes, stratoliners, luxury streamliners, limousines, bicycles, and pogo sticks. Some are even hoping to get to the scene of the excitement by expert use of the beckoning thumb. Byron Landis and Johnny Rife, in charge of reservations for the Nomads' train out of Los Angeles, tell us that they already have two private pullman cars stuffed to the ventilators, and the end is not yet. By the time this comes off the press, we personally shall have been carried eastward in a great irresistible movement, heaven help us, and we can merely hope that we shall ride the wave unscathed. But more of this anon—for the moment leave us take a look at the current events.

Frixample, we learn via one limb of the grapevine that a very lovely young lady—Ellen Georgia—arrived recently at the home of John Hills and his good lady, and liked the place so well she is going to stay. She carried no baggage, and, like most ladies, didn't have a thing to wear, but the Hills are going to take care of that, and meantime, our congratulations on the acquisition of this interesting new boarder. By way of explanation, John Hills is an able disciple of Pegasus, and holds sway at Vernon, of which Los Angeles is an inconsequential suburb—or so they say in Vernon. John is also a slinger of distinction on the Trembley bailing octet, and handles a mean jigger if he does say so himself.

Speaking of such matters recalls that as we write, last minute preparations are afoot for the Production Pioneers' Broilecue at Brea, California, and the latest census indicates that any oilman who stays in town on the day of this fracas is likely to be a mighty lonesome joe. Swede Larson, Ox Morgan, and their several cohorts have conscripted Bill Butler, Union's Santa Maria production chief, and broiler extraordinary, to take care of the eats, and Bill is reputed to have a right delicate touch in such matters. Steers with tender steaks fly in terror at his approach, but he is not to be denied, and we would hesitate to say just how many Holsteins are now running around the plains of California without their top sirloins. Incidentally, it is rumored in the derrick groves that Cy Rubel is going to play a few classical numbers on the musical saw, just to show what can be done with a real flair for music and a serrated edge. Also, comes word that Bill Kinder, the handsome Emsconian, has been sub rosa organizing a barber shop quartet to stop all barber shops. The story is that the boys have already made so much progress it is now possible to tell immediately whether they are singing or just having a friendly argument. Jim Gosline is down from San Francisco tying all the tag ends together, and the way he has them pleated, if this isn't the biggest party ever staged by the pioneers we will gladly eat our last winter's fedora without even removing the ribbon.

●

Now skidding across the continent for a confab with our very efficient Mid-Continent eye, we learn that Bill Laves, an energetic consulting engineer and geologist, from the renowned bailiwick of Tulsa, has taken himself out of the oil show town, and is now associated with the firm of Kirkpatrick and Bale in Oklahoma City. When a geologist moves from one place to another it reminds us of the mud smeller's version of the rolling stone proverb, to wit, "A revolving fragment of Paleozoic age collects no cryptogamous vegetation." That, however, has nothing to do with the case. What we intended to say was that Bill Laves a lot of good friends back in Tulsa who are wishing him the most of the best in his new enterprise.

●

And, it is reported that Johnny Murrell, the genial manager of the DeGolyer and McNaughton organization, has a pronounced interest in the sport of kings—horse racing to youze laymen. Effen that ain't so, how come every time he calls on his aides for

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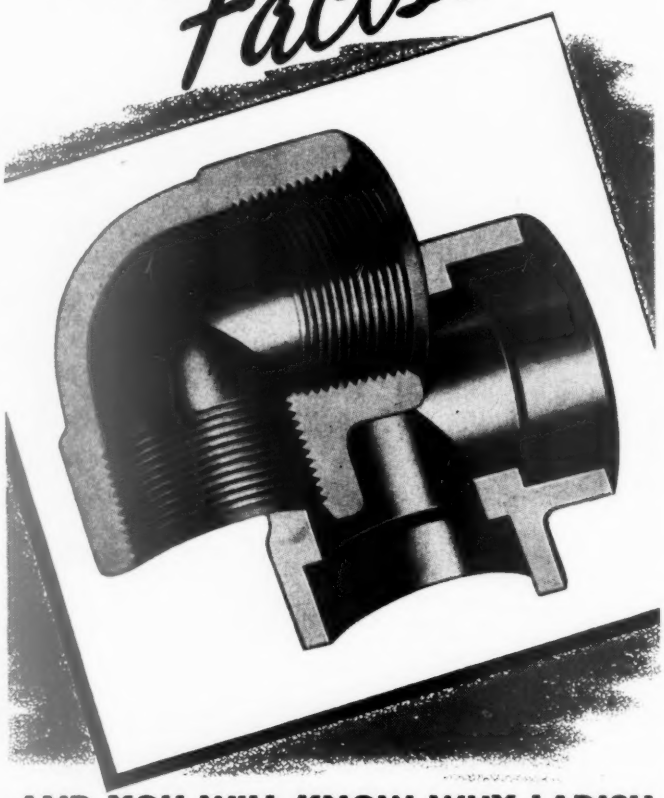

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Fact Controlled grain flow provides maximum resistance to shock, strain and stress.

Fact Dense, homogeneous metal structure retards action of erosion and corrosion.

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a report on the Santa Ana gas field, he always asks, "What is the news from Santa Anita?" We have always claimed that where there is smoke there is tobacco or something. And we might add by way of warning that the bank balance of many an oil man bears mute evidence of a lost race. We are not speaking of the Aztecs either.

●

A visitor in Dallas quite recently was Dr. Clark Goodman, physics prof at MIT, and director in physics of API's project 43-C, which seeks to evaluate the importance of radioactivity in the genesis of petroleum. The Doctor addressed the Dallas Geological Society as a distinguished lecturer for the AAPG, and really gave the members an interesting evening. Armed with a geiger counter, slides, and all the paraphernalia of a sub-atomist, he demonstrated the activity of various emanations and radiations in crackling bombardments, and meanwhile discussed what he termed the "geological fence." This, as nearly as we can understand it, is a compilation of the conditions and phenomena that would have to be exhibited before plant and animal remains could be transformed into petroleum. Most theories about the origin of petroleum appear to be somewhat confounded by this fence, that is, available carbonaceous material could not have been converted into petroleum without the imposition of excessive temperatures or a plentiful supply of rare catalysts. Anyway, what we think the good Doctor intended to convey is that the transmutation may have been contrived by certain types of emanation from radioactive substances. It is all so ridiculously simple that we wonder why anybody even bothers to mention it. By way of excuse, however, we might say that we have always been an outstanding student of science. When we were just a mere stripling or sapling or something our chemistry teacher asked us to name three articles containing starch, and without hesitation we barked, "Two collars and one shirt."

●

Bert Dowd of Union Producing Company and his fellow API officers staged a right nice spring meeting, we are told, at San Antonio a short time agone. Sharing the honors with Bert were such solid citizens as John Boldrick, the Humbletonian from New Orleans; T. R. Bibee, Gulf Oiler, from Laurel, Mississippi; Roland Gouldy, Bridwell Oiler from Wichita Falls; V. J. Martzell of Rosenbloom Pipe Company at Shreveport; J. N. Mills, Cities Service, Gladewater; J. U. Teague, Hogg Oil, Houston; Ed Warren, ex-prexy of AAODC, and R. S. Christie, Amerada, Fort Worth. Between them this group of petrolic luminaries cooked up a program of events that had everybody as tickled as the small boy who was sent to a revival meeting, but went accidentally into the wrong tent and found himself at the circus.

●

It is a bit late to be telling Easter stories but this one is too good to pass over. Our Mid-Continent eye, and we may as well unmask him, Marsh Fagin, in the manner of a dutiful father hid a scad of hard boiled oeufs around his home, among the bushes, and on the lawn, for the particular entertainment of his son, David—nine years old. But Marshall didn't know that the family pooch, a female, named Sally, had a terrific yen for hen fruit in congealed form, and so, when he took David out on Easter Sunday for the hunt, imagine his consternation to find that of the 14 eggs he had hidden, Sally had found—and eaten—nine. And, says Marshall, indignantly, "They're only fifty-three cents a dozen, too!" We've heard it said that stealing eggs is a dangerous way to get the lay of the land, but we haven't heard what happened to Sally in this case.

●

Some years ago, Frank Hill, then director of production for Union Oil Company of California, was dictating an urgent report on activity in the San Joaquin Valley for a period of some six months. His regular secretary was not available at the moment, so he called in a girl from the reception room to take his notes. She was quite uninformed on the semi-geological lingo of the field man, and the results were a little more than mildly amusing. Speaking of a play in the Belridge field, which had been a failure, Mr. Hill said, "Perhaps the greatest disappointment that Union Oil Company has experienced in the past six months was the encroachment of edge water into the principal member of the Temblor." When he received the typewritten report from the young lady, what she had said was, "Perhaps

the greatest disappointment that Union Oil Company has experienced in the past six months was the *encroachment of water into the principal members on the tenth floor.*" Frank, incidentally, was born in Missouri, but while he was still a child, his folks moved out to the little town of Fillmore in California, and he went to school in Santa Paula, where he watched Lyman Stewart, Milton Stewart, Wallace Hardison, Thomas Bard, and other pioneer greats going about their work. He always says that the thing that most impressed him in his youth about oil men was that they were better dressed and rode better horses than the other people in the neighborhood, which had a profound influence on his own decision to get into the swim.

●

Speaking of pioneer days, one of the most interesting living pioneers out California way is Albert Enrique Fowks, who was just a boy 11 years of age when he went to Peru to join his father in 1878. The latter had gone down some years before to become associated with an erstwhile school friend, Henry Meiggs, in developing the natural resources of Peru and Chile. Having been a successful operator in the young Pennsylvania oil fields, he was especially assigned to test the petroleum possibilities of northern Peru. Under his direction three wells—producers, too—were drilled in the Negritos area in 1874, proving the field and starting a boom that resulted in the construction of a refinery at Talara. When Albert Enrique arrived in Peru, it was the beginning for him of a remarkable oil experience that has lasted for a full 70 years. He has never in all that time been separated entirely from the petroleum business, and today at 81 years of age is as alert, interesting, and interested as many a much younger man. It might be mentioned that he was originally christened Albert Henry, but the Peruvians soon gave that Henry its Spanish interpretation. Incidentally, his two sons, Al and Ernie, well known California oil men, were born in Peru, and all three, father and two sons, are senior members of the Petroleum Production Pioneers. It takes 30 years of actual field experience to qualify for that honor, which makes the Fowks family a very unique institution. And, if we may be forgiven a rather atrocious pun, they're nice Fowks.

●

Ronnie Heath, recently elected a vice president of Signal Oil and Gas Association, is a native Californian, born in the town of San Jose, educated at Stanford University, and despite his youthful appearance, a veteran of the air service in the first world war. He began his association with Signal Oil and Gas Company in 1923, and has largely confined himself during that time to the development of natural gasoline production, which was a very hazy business when he first got into it. He is an ex-prexy of California Natural Gasoline Association, and we remember him very well as an especially good performer on the rostrum. He has also been strongly active in API and AIME. His home is directly on the ocean front at Long Beach within a short distance of Alamitos Bay, so it is quite natural that his principal amusement should be swimming. We don't like to boast but having hung around pool halls a lot, we are quite the swimmer, too. In fact, we have long been considered one of the foremost proponents of the Australian crawl—that's the one where you go "down under" and crawl.

Wherewith we leave you to your own devices. All being well we shall see you at the Oil Show, and if you don't get there, don't worry, we will give you the scandal in the next issue. Cheerio!

Holds press conference

The Pelton Hydraulic Pumping Jack Department of The Pelton Water Wheel Company held an informal press conference at the Biltmore Hotel in Los Angeles on April 21 for members of the various oil trade publications in order to acquaint the editorial and feature writers of the oil publications with the development history, theory of operation, and field record of the Pelton Long Stroke Hydraulic Pumping Jack. W. F. Boyle, vice president and general manager of Pelton, acted as host.

C. J. Woodard, manager sales-service, gave a short talk on the inherent advantages of the long slow stroke in rod pumping of oil wells.

L. D. Alward, chief engineer, gave a short talk on the theory of operation of the Pelton jack, and J. W. Young, shop superintendent, gave a short talk on the manufacturing methods of the Pelton Long Stroke Hydraulic Pumping Jack.

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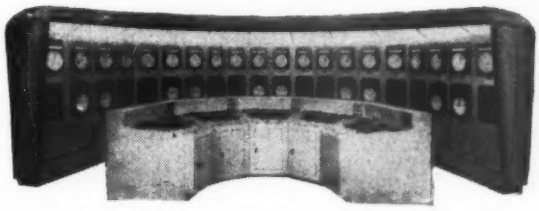

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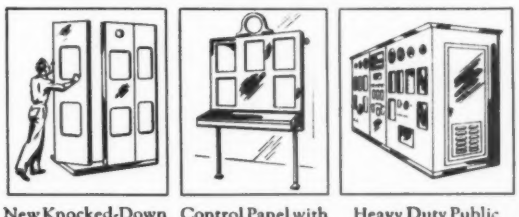

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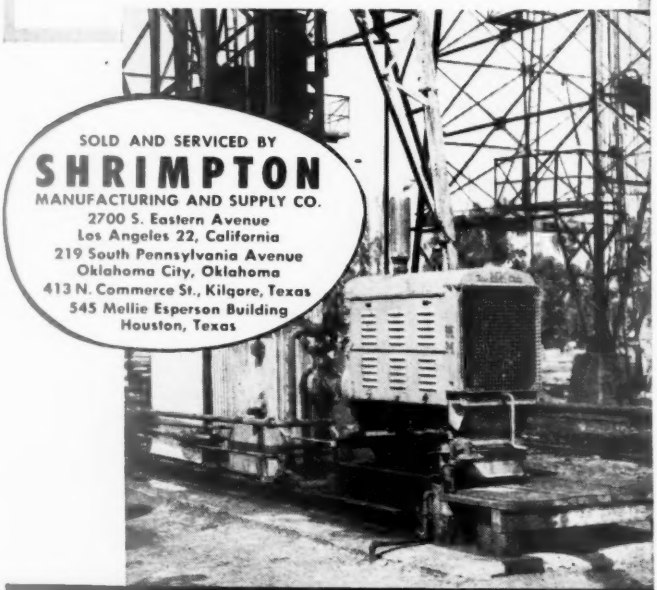

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Catalytic Construction officers

At the annual meeting of Catalytic Construction Company, directors were elected exclusively from operating management. The following elections and appointments were made: John D. M. Hamilton, David N. Hauseman, W. Graham Jamison, Alan T. Knight, Harmon J. Monnik, Claude C. Peavy, and T. Ellwood Webster were elected directors.

Officers are David N. Hauseman, chairman of board; T. Ellwood Webster, president; Alan T. Knight, vice president; Claude C. Peavy, vice president; John D. M. Hamilton, secretary; W. Graham Jamison, treasurer, comptroller, and assistant secretary, and John A. Schumacher, assistant treasurer.

Hughes Tool expands executive staff

Hughes Tool Company, Houston, Texas, through Fred Ayers, senior vice president of the Oil Tool Division, announced recently expansion of the company's executive staff including three new vice presidents elected by the board of directors. The newly appointed executives, Dan J. Martin, M. E. Montrose, and Harry E. Rogers, all have been associated with the company for some time and were promoted by the company to their new capacities after having completed exhaustive studies in their respective divisions during the past year in connection with the company's expansion program. Martin becomes vice president—engineering and research; Montrose, vice president—sales, and Rogers moves from his present capacity as manager of production to vice president—manufacturing.

Before joining Hughes in 1946, Martin spent some 22 years in military service. At the time of his retirement he held the rank of colonel and had advanced to service as executive officer to the Chief of Ordnance, U. S. Army. Colonel Martin directed research and development of centrifugally cast cannon prior to World War II, and during hostilities supervised the production, procurement, and inspection of all cannon and major aircraft armament. He is known in industrial circles as one of the nation's leading metallurgical and research engineers.

M. E. Montrose is well known throughout the oil industry of the nation as a sales and administrative executive, having established intimate contact with the oil industry during his many years association as an executive of the General Electric Company and later as vice president and general sales manager of the Lane-Wells Company. Immediately prior to joining Hughes in 1946, Montrose was a director, president and general manager of the Marion Power Shovel Company of Marion, Ohio.

Harry E. Rogers has enjoyed a long and successful career in production engineering in executive capacities, beginning with his association with the American Car and Foundry Company in 1910. Later he became works engineer for Commonwealth Steel Company after which he transferred to the General Steel Castings Corporation in Pennsylvania in similar supervisory capacity. Rogers was works manager of the huge Nordberg Manufacturing Company of Milwaukee, Wisconsin, when Hughes invited him to join the company as manager of production in June, 1945, a position he has since held until the current promotion to his present new duties.

The appointments of the three new vice presidents and the creation of their special supervisory duties follows a long range plan of expansion and accelerated production envisioned by the board of directors of Hughes.

Noah Dietrich, executive vice president, was high in his praise of the company's expansion plans and the selection and promotion of executive personnel to increase the company's scope of operations. "Since Fred Ayers assumed the managerial direction of the Oil Tool Division of Hughes as senior vice president in October, 1944, he has spurred departmental interest in increased production and product research, while sales and service in the field have been extended." Dietrich stated. "The plans now being put into actual operation are the result of concentrated studies by Mr. Ayers and the application of formulas gained from a wide background of domestic and international production and administrative experience. Hughes' enlarged operations in its every field of activity will be immediate," Dietrich said.

In his broad career prior to joining Hughes some four years ago as a senior executive and overall director of the Oil Tool Division of Hughes, Ayers was one of the nation's leading consulting analysts in the domestic industrial field and spent eight years abroad reorganizing motor manufacturing companies and other industrial plants in Britain, Italy, France, and Russia. In

the early stages of the last war Ayers was called upon to assist in war preparations, and became first civilian advisor to General Burton O. Lewis in Ordnance, and later was drafted by General Knudsen to serve as assistant chief of WPB's aircraft manufacturing section. In 1943 he was invited to assist in reorganization of Hughes Tool Company's aircraft plant and after completing that mission was assigned to his present capacity with the Oil Tool Division of Hughes in Houston where his duties as senior vice president directly responsible to Noah Dietrich place him as the company's third ranking executive.

Company televises annual report

An innovation that recently created quite a buzz around the financial lanes of the country was Union Oil Company of California's televised annual report, which was released in nine cities, stretching from Los Angeles to New York, on Tuesday night, April 13. The telecast took the form of a normal stockholders' meeting with Reese H. Taylor, president of the company, aided by his executive committee, explaining whence came the sizable income that Union enjoyed in 1947 and how this income was or will be distributed.

The film opening showed Reese Taylor in the chair, flanked by W. L. Stewart, Jr., executive vice president; A. C. Rubel, vice president; A. C. Stewart, vice president; and H. W. Sanders, vice president and treasurer. In turn as they were introduced, each executive gave an interesting account of the functioning of his department or departments. These elucidations were illustrated with "flashbacks" to the field, refinery, and other operating areas and plants, and the whole presentation was distinctly effective.

The story even had a plot: "What became of the $171,788,000 more or less that Union Oil Company took into its coffers briefly in 1947?" It was all explained convincingly and in easy stages, by simply taking the cost of doing business, including, for example, such items as raw materials, supplies, wages, and taxes, and showing that *in toto* it amounted to approximately $123,574,000. Then came the cost of staying in business, made up of expenditures for research, exploration, drilling and development, replacement, expansion, etc., accounting for another $48,889,000.

So it eventually developed that all the income and an additional $675,000 to boot, had been spent or was about to be spent in the extremely worthy effort, not alone to do business now, but to keep on doing business in an adequate way. The televising of Union Oil Company's "Report For '47," was an experiment with a new method of presenting financial information. There is no question of its success. This telecast may be improved upon—it undoubtedly will—but in the meantime, it marks the introduction of a medium of education that is likely to become popular in the very near future.

Heads Producers Agency

L. A. Cranson, executive vice president and a director of Honolulu Oil Corporation, was elected president of Oil Producers Agency at its annual meeting in Los Angeles. Cranson succeeds W. C. Whaley, vice president and manager of Barnsdall Oil Company California operations, who has been Agency president for the last two years.

In addition to his Agency presidency, Cranson is also a director of Kettleman North Dome Association, and during the war was a member of the Production Committee for District 5, under the Petroleum Administration for War. He has been a director of Oil Producers Agency for the past several years.

Other officers elected at the Agency meeting were H. E. Woodworth, first vice president, Safe Oil Company, Bakersfield; R. A. Grant, second vice president, Fullerton Oil Company, Los Angeles; C. C. Spicer, third vice president, Republic Petroleum Company, Los Angeles; C. A. Johnson, fourth vice president, Holly Development Company, Los Angeles.

Rush M. Blodget, who has been executive vice president of the organization since it was founded 18 years ago, was reelected to that office.

W. A. Russell, Seaboard Oil Company, was elected secretary treasurer, and Verne Harrell, Bankline Oil Company, was elected assistant secretary treasurer.

Directors whose terms had expired were all reelected. They are: J. M. Feldman, Ralph B. Lloyd, D. T. Staples, H. E. Woodworth, R. H. Garrison, M. A. Machris, C. P. Watson, Roy W. Young, Jas. H. Lewis, L. K. Whittier, and Chas. T. Wilson.

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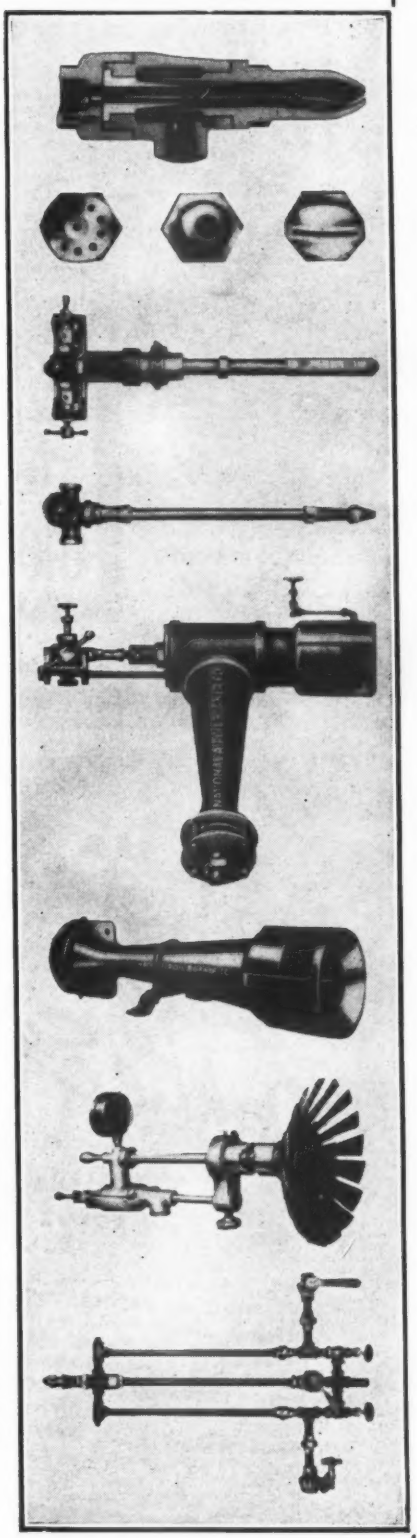

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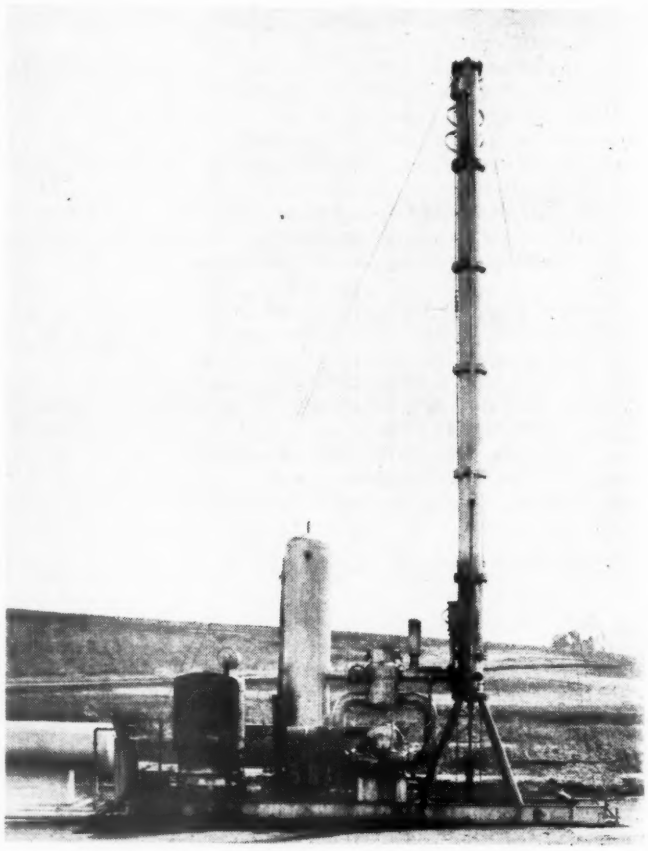
Axelson purchases pump jack

J. C. Axelson, president of the Axelson Manufacturing Company, has announced that his firm has purchased exclusive manufacturing and sales rights to the pumping unit that has established such a remarkable service reputation on the West Coast under the name Vernon-Suter Hydraulic Pump Jack. In the future, this unit will be manufactured, marketed, and serviced under the Axelson name.

The Axelson Hydraulic Pump Jack is adaptable to polished rod loads up to 32,000 lb and strokes of 25 ft or longer. It features a constant load on the rods with soft, cushioned reversals and ability to pump from unusual depths without rod failures. The jack operates on a low pressure cycle, is easily portable and simple to understand and service, it is asserted. Another outstanding feature is the extreme ease with which this unit permits spacing the well.

Axelson Manufacturing Company will have a pump jack on exhibition at the Tulsa oil show, where complete technical data will be available.

The purchase, by Axelson, of the manufacturing and sales rights to the hydraulic long stroke unit only, will in no way affect the normal operation of the Vernon Tool Company, Ltd., it is stated. Vernon will continue to manufacture and supply to the petroleum trade such items as centrifugal desanders, vibrating mud screens, centrifugal pumps, and Western engines, as well as other production equipment and general oil field machine work.



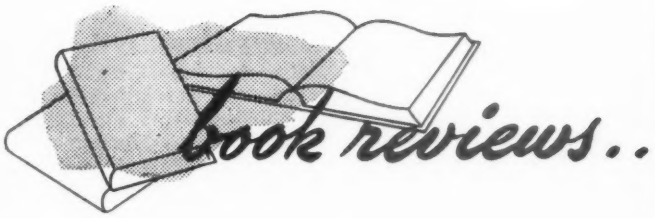
Vernon-Suter hydraulic pump jack.

S.A. representatives for OCT

Oil Center Tool Company, Houston, Texas, has made arrangements with two experienced oil field operators to represent them in Venezuela, Colombia, and Peru. They are Elmer D. Hall and J. E. (Jimmy) Berry.

Hall, who will be stationed at Puerta La Cruz, Venezuela, was formerly employed with the Superior Oil Company as drilling superintendent, in California and Louisiana, and for some time has been connected with the Weatherford Spring Company, manufacturers of oil well cementing equipment.

Berry will be drilling superintendent in Maracaibo. He has been connected with the oil industry since 1933, having worked in Texas and Louisiana before going to Western Venezuela ten years ago as an employe of the Shell Oil Company.



● **Spanish-English Engineer's Dictionary,** *by Louis A. Robb. John Wiley and Sons, 440 Fourth Avenue, New York 16. Price $6.50; in Canada, $7.80. Pages, 423.*

Forty-four thousand current Central and South American engineering terms, with their local variations, are presented in this technical dictionary.

The vocabulary of civil and construction engineering terms will prove helpful in translating engineering plans, specifications, reports, contracts, and technical magazine articles. In addition, there are many mechanical and electrical terms, as well as important terms in geology, chemistry, and allied sciences. The book is a valuable source of technical Spanish and English terminology.

● **Selected Values of Properties of Hydrocarbons,** *Circular C461. National Bureau of Standards, Washington 25, D. C. Pages, 483. Price, $2.75.*

A complete collection of all the numerical tables, as of May 31, 1947, issued by the cooperative research program of the API and the National Bureau of Standards, known as the API Research Project 44.

Some of the aims of the project are as follows: (1) Examination of pertinent original data, (2) correlation of values of given properties, (3) making original calculations as necessary, (4) selection and tabulation of the "best" values of the properties, (5) preparation in convenient, usable form, suitable for publication, and (6) up-to-date revision.

This project, begun in 1942, was carried out in a cooperative program by a staff of experts.

● **Surface Chemistry for Industrial Research,** *by J. J. Bikerman. Academic Press, Inc., 125 East 23rd Street, New York 10. Pages, 464. Price, $8.*

Fundamental knowledge in this book may be used as a base for further industrial application of surface science in any industry. Included are factors often overlooked, such as roughness of solid surfaces and their chemical and physical inhomogeneity, the miscibility of "immiscible" liquids, and the sensitivity of all sorts of physical quantities to common impurities. Surface physics also are covered, with a minimum of attention given to hypothetical theory. This will prove useful to research workers in industrial and scientific laboratories and to graduate students.

● **Polymerization of Acetylene to Cyclooctatetraene,** *by Karl Kammermeyer. Hobart Publishing Company, Box 2147, Chevy Chase Branch, Washington 15, D. C. Pages, 130. Price, $17.50.*

Forty pages of translated German combined with the corrected and revised English text of the original report make up this book on a development in chemistry that is said to be the most original piece of work uncovered by Allied teams in interrogation of the German scientists. Particular care was taken to give the exact meaning for the experimental work as reported in the German part containing the patent applications and examples. Tables and many illustrations round out this factual presentation, important to technologists.

● **Reviews of Petroleum Technology,** *Volume 7, 1941-1945. The Institute of Petroleum, Manson House, 26 Portland Place, London, W.1, England. Pages, 535. Price, 21s.*

During the war years much progress was made in every branch of the petroleum industry. The present volume (the first since 1940) collects, collates, and reviews references to over 3000 articles, which appeared during 1941 to 1945. Chapter headings include all phases of the petroleum industry with other chapters covering natural gas, LPG, benzole, alternative fuels, diesel fuel, asphaltic bitumen, special products and petroleum literature. To the busy research worker, student, and librarian the volume affords a ready source of information as to the location of scientific data and to the scope of such data.

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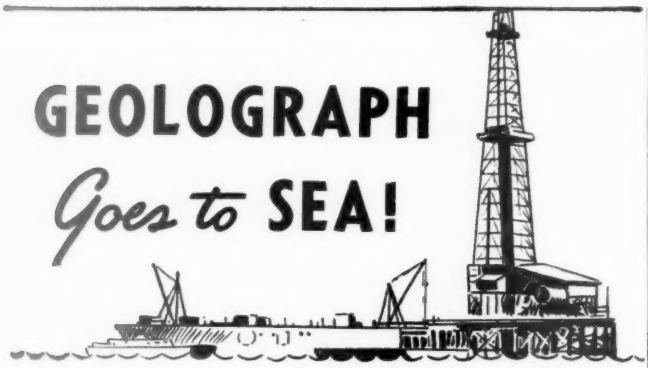

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Heads Babcock and Wilcox

A. G. Pratt, president of The Babcock and Wilcox Company, was elected chairman of the board, and Alfred Iddles, vice president, was elected president and chief executive officer of the company, at the recent meeting of the board of directors.

Pratt has been with the company for 45 years, during seven of which he served as a vice president and 24 years as president. Iddles, who has been engaged in engineering and construction work all his business life, joined the company in 1937 and became a vice president in 1945.

W. T. McCullough, Jr., who is in charge of stationary boiler sales and was formerly sales manager of the Chicago office of the company, was elected a vice president, and W. G. Dryden, formerly treasurer, secretary and treasurer. C. W. Middleton, vice president and secretary, has withdrawn from full-time active service in the cmpany but will continue as a director and in a consulting capacity.

Pacific Coast API

With more than 1000 oil men in attendance at some of the sessions, the opening meeting of the Pacific Coast District, API Division of Production was held on Thursday and Friday, May 6-7, at the Los Angeles Biltmore Hotel. Those attending heard top men in the industry speak on technical, economic, and political aspects of oil in the world today.

With E. V. Watts, chairman of the Coast District, presiding, the two-day meeting was divided into sessions on production and drilling, and was highlighted by a banquet on the night of May 6 at the Biltmore. Main speaker was Harold F. Sheets, retired chairman of the board of Socony-Vacuum Oil Company, who spoke on the Middle East.

Topics and speakers at the production section of the conference were: "Limitations of Rod Pumping," by K. T. McCamman, Shell Oil Company, Inc., Bakersfield; "A Subsurface Flow Rate Indicator And Its Applications," by F. M. Carlisle, International Cementers, Long Beach; "Economics of Cyling Retrograde Reservoirs," by Milan Arthur, Union Oil Company of California, Whittier; "A Method of Predicting Recovery of Oil by Water Flooding," by R. L. Parsons and Herman Dykstra, California Research Corporation, La Habra; "Application of Secondary Recovery in United States as Related to Emergency Oil Requirements," by Paul D. Torrey, consulting engineer, Houston, Texas.

Joins Liquid Conditioning

Liquid Conditioning Corporation of Linden, New Jersey, announced that E. Philip Kron has joined its Buffalo, New York, representative, Brookman-Hazel Associates, as partner of that organization.

Kron is a civil engineering graduate from Massachusetts Institute of Technology. Since his graduation in 1934, he was continuously associated with the Kodak Park Works of Eastman Kodak Company until World War II. During the war, Kron was engaged for more than four years on procurement, distribution, and maintenance for the Air Technical Service Command at Wright Field, where he attained the rank of lieutenant colonel.

At Brookman-Hazel Associates, Kron's work will include field engineering service for Liquid Conditioning Corporation in the Buffalo district, with headquarters at 259 Delaware Avenue, Buffalo 2, New York.

Attends sales meeting

I. W. Hebner, Chicago industrial manufacturing and sales executive, was in Houston, Texas, recently to attend the Well Equipment Manufacturing Corporation three-day general sales meeting on Okadee products, manufactured by one of the companies of which Hebner is a vice president and director. Okadee products are distributed in the greater Mid-Continent oil area by the WECO organization.

Hebner is vice president in charge of industrial, oilfield, and marine sales for The Okadee Company, Chicago.

During his visit to Houston, Hebner made an extensive tour of refineries and oil fields in the Houston and Gulf Coast area.

Members of the WECO sales organization from throughout the entire Mid-Continent area were in attendance at the meeting.

H. G. Hagn, vice president and general manager; G. R. Winder, vice president and sales manager, and T. T. Word, Jr., assistant sales manager, of the Well Equipment Manufacturing Corporation, addressed the sales group during the three-day meet.

Named Koebelite distributor

Oil Base, Inc., Compton, California, manufacturers and distributors of Black Magic oil base drilling fluid, has been appointed national distributors for Koebelite diamond bits, one of the newest developments for coring in hard areas.

With branch offices in Bakersfield, Long Beach, Ventura, Midland, Houston, Lindsay, Oklahoma City, and Vernal, Utah, Oil Base, Inc., plans to introduce Koebelite diamond bits through its sales and service engineers in these areas.

Sales policy changes

The Meriam Instrument Company, 10920 Madison Avenue, Cleveland, Ohio, announces a change in sales policy throughout its Western Division. To provide more direct application information on Meriam products, G. M. Cooke at 270 Fremont Street, San Francisco, California, and Charles Meriam at 6311 North Figueroa Street, Los Angeles. will be exclusive representatives for the company. Arrangements with The American Meter Company, former jobbers, have been terminated; stock will be carried by the representatives.

A & I gas course

An advisory committee of industrialists has been chosen for the Third Annual Short Course in Gas Technology, Dr. E. N. Jones, president of Texas A & I College, Kingsville, has announced.

Sponsored by the Southern Gas Association, the short course will be presented by A & I June 2, 3, and 4. Dr. Frank H. Dotterweich, director of the A & I engineering division, is administrative committee chairman for the third year.

Chester L. May of the Lone Star Gas Company is chairman of the advisory committee.

Other advisory committee members are A. D. Green, United Gas Pipe Line Company; Frank S. Kelly, Jr., Arkansas Louisiana Gas Company; J. P. Bristow, Tennessee Gas Transmission Company; J. C. Flanagan, United Gas Corporation; A. L. Kleberg, King Ranch; John Lynch, LaGloria Corporation; Harold E. Meade, New Orleans Public Service, Inc.; R. W. Reeves, Oklahoma Natural Gas Company; Frank C. Smith, Houston Natural Gas Corporation; Dean Strickland, United Gas Corporation; Col. L. O. Vogelsang, Rio Grande Valley Gas Company; R. E. Wertz, Amarillo Gas Company; C. R. Williams, The Chicago Corporation; W. Lee Woodward, Zenith Gas Company; and C. H. Zachry, Southern Union Gas Company.

Inspect drilling equipment

Inspecting equipment for deep exploratory drilling in Mexico, which has just been purchased from Franks Manufacturing Corporation by Marshall and Smith, Artesia, New Mexico, drilling contractors, are: Daniel Laso, left, representing Petroleos Mexicanos for whom Marshall and Smith are to do the drilling; Mrs. F. B. Marshall, Leon Smith, and Marshall. The unit is a skid mounted Franks SAL 5000 drilling rig powered by two D-17000 Caterpillar diesels and equipped with a Franks 96-foot derrick. Due to the marshy conditions in the Mexican area, the rig will be transported by Athy wagons.

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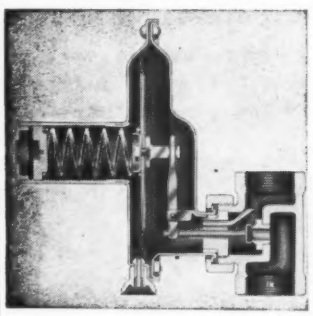

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